CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
DEPARTMENT OF PHYSIOTHERAPY

CASE STUDYOF PHYSIOTHERAPY TREATMENT OF A PATIENT WITH DIAGNOSIS AFTER ANTERIOR CRUCIATE LIGAMENT SURGERY

BACHELOR DEGREE OF PHYSIOTHERAPY
BACHELOR THESIS

Author: **Pavlos Chartosias**
Supervisor: **Mgr. Ivana Jelínková**

April, Prague 2014

Abstract:

Title: Case study of diagnosis of Anterior Cruciate Ligament surgery

Author: Chartosias Pavlos

Aim:

In the thesis I will be analyzed the function and the mechanism of the knee joint, understanding the kinesiology relation with the Anterior Cruciate Ligament, focusing on the main principles and procedures of the therapy and rehabilitation after one day of surgery.

Methods:

The therapy included five meetings with the patient during two weeks of clinical practice. The patient had physiotherapy in the morning at the same time. The main goal for the first five days after surgery was to archive as bigger Range Of Motion was possible in the operated knee joint, remove the pain, strength and relax a group of muscles, mobilized any blocked joint and educate the patient how to use the crutches physiological and how can be independent as much possible.

Results:

Our therapeutic relation between me and the patient was perfect. After five days of therapy my patient archives 50 degrees flexion in the operated knee joint from 0 at the first day. Her doctor was very satisfy, that's why he indicated to her that she is able to go home after the fifth day of my therapy because my therapy was effectiveness and the results were positive.

Key words: Anterior Cruciate Ligament, Range Of Motion, Post Isometric Relaxation, KNEE JOINT

Acknowledgement:

As I complete my three years of studies, I want to express many thanks to my Mother who was always by my side in all this three years. Without her support I would not do anything. Daily she reminds me how wonderful person with morals is. I will always make her proud.

Another person who plays the most important role during my studies is my girlfriend. During these 3 years she was strong person always by my side, supporting me in all difficulties and she never let me alone.

I want to give a lot of thanks to my supervisor Mgr. Ivana Jelinkova for helping me during my thesis and also for her knowledge that she passed me during my academies years in Charles University in Prague.

Special thanks to all the teachers of the department of physiotherapy in Charles University in Prague, who plays important role for my physiotherapeutic knowledge that I have. I will always respect them and I will apply everything under there rules in the feature in my private work.

Many thanks to my supervisor in Ústřední Vojenská Nemocnice in Prague Dis. Petr Smejkal, who was supervising me at these two weeks in my practice. I took a lot of practical skills from him that I will never forget.

Finally I would like to thank all my classmates for all the memories we all have in the last three years, it was a great time with them. Having the opportunity to study physiotherapy in Charles University in Prague was fantastic experience for me.

Declaration:

I declare that this Bachelor Thesis has been based entirely on my own individual work and on my own practice that took place in Ústřední Vojenská Nemocnice in Prague from 3/2/2014 till 14/2/2014. All the information used for the development of this Bachelor Thesis has been taken from the list of literature that exists in the end of this Thesis. My practice was under supervision of my supervisor Dis. Petr Smejkal and by Mgr. Ivana Jelinková in department of physiotherapy, in Faculty of Physical Education and Sport of Charles University in Prague.

In Prague 20.4.2014 Chartosias Pavlos

TABLE OF CONTENTS

1. PREFACE

From my young age, I and the physiotherapist had a very close relation. From my 7 years old until 17 years old I was a professional Shotokan Karate athlete. I used to have Black belt in Karate (1st Dan) as I am a member of World Karate Federation (**W.S.K.F no: 00042**). So in all this ten years I took place in many tournaments in Cyprus and in the whole Europe and also I used to have daily workout. In all these years I had a lot of injuries, accidents and fractures in my whole body so I must had a personal physiotherapist maintaining me and rehabilitating me when I had problems. During these years I started come close and more close to the physiotherapy because I had therapies 2-3 times per week. After a long time of therapies, I loved physiotherapy because it was helping me in my condition and made it me able to challenge with others athletes. So I understand the importance of physiotherapy and I liked the way how a physiotherapist works with the patients, and from that age it was my dream to be a perfect physiotherapist and helping people with a global types problems.

In this thesis my main goal is to describe the role of function of Anterior Cruciate Ligament relation with the knee joint and the therapeutic approaches for the rehabilitation after an acute surgery. Rupture of Anterior Cruciate Ligament is very common injury especially in the professional athletes. I will try to generally describe the Anterior Cruciate Ligament related to the knee joint and describe the therapeutic approach on my patient in clinical practice that I had for 2 weeks in Ústřední Vojenská Nemocnice in Prague.

2. GENERAL PART

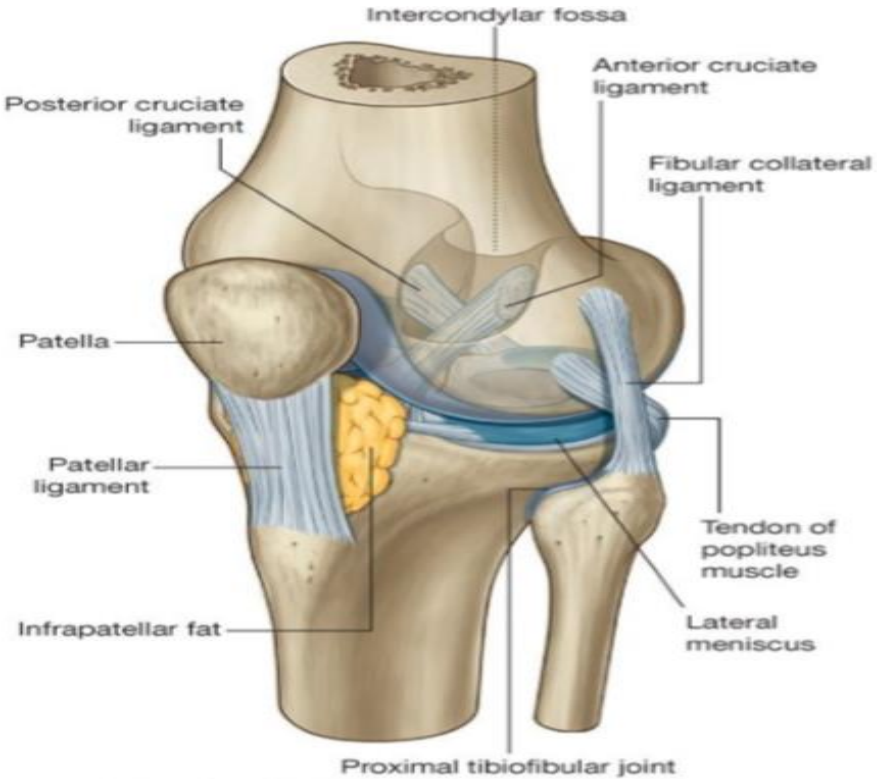
2.1. Anatomy of the knee joint

The knee joint (pic.1) is the largest synovial joint in the body. It consists of:

The articulation between the femur and tibia, which is weight bearing; and the articulation between the patella and the femur, which allows the pull of the quadriceps femoris muscle to be directed anteriorly over the knee to the tibia without tendon wear [3].

Two fibro cartilaginous menisci, one on each side, between the femoral condyles and tibia accommodate changes in the shape of the articular surfaces during joint movements [3].

The detailed movements of the knee joint are complex, but basically the joint is a hinge joint that allows mainly flexion and extension. Like all hinge joints, the knee joint is reinforced by collateral ligaments, one on each side of the joint. In addition, two very strong ligaments (the cruciate ligaments) interconnect the adjacent ends of the femur and tibia and maintain their opposed positions during movement, because the knee joint is involved in weight bearing, it has an efficient "locking" mechanism to reduce the amount of muscle energy required to keep the joint extended when standing [3].



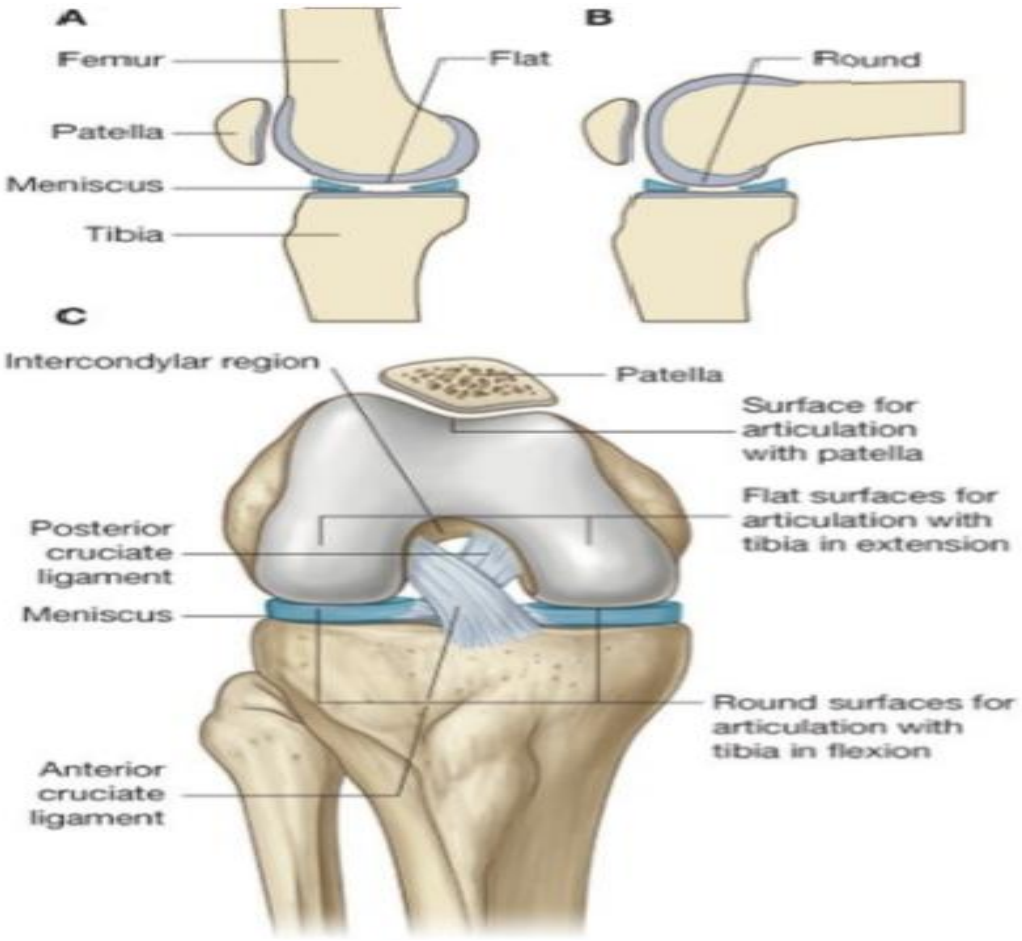
Picture No 1 - Anatomy of the knee joint [3].

2.1.1.Bones of the knee joint

The articular surfaces of the bones that contribute to the knee joint are covered by hyaline cartilage. The major surfaces (pic.2) involved include: the two femoral condyles and the adjacent surfaces of the superior aspect of the tibial condyles [3].

The surfaces of the femoral condyles that articulate with the tibia in flexion of the knee are curved or round, whereas the surfaces that articulate in full extension are flat [3].

The articular surfaces between the femur and patella are the V-shaped trench on the anterior surface of the distal end of the femur where the two condyles join and the adjacent surfaces on the posterior aspect of the patella. The joint surfaces are all enclosed within a single articular cavity, as are the intra-articular menisci between the femoral and tibial condyles [3].



Picture No 2 – Bones of the knee joint [3].

2.1.2. Ligaments of the knee joint

Anterior and Posterior Cruciate Ligaments**:**

These ligaments within the capsule that connect the tibia and femur. The anterior and posterior cruciate ligaments are named based on their origins relative to the inter condylar area of the tibia (pic.3). From their origins, they cross on their way to their destinations on the femur. Anterior cruciate ligament (ACL) extends posteriorly and laterally from a point anterior to the intercondylar area of the tibia to the posterior part of the medial surface of the lateral condyle of the femur. The ACL limits hypertension of the knee (which normally does not occur at this joint) and prevents the anterior sliding of the tibia on the femur. This ligament is stretched or torn in about 70% of all serious knee injuries. Posterior cruciate ligament (PCL) extends anteriorly and medially from a depression on the posterior intercondylar area of the tibia and lateral meniscus to the anterior part of the lateral surface of the medial condyle of the femur. The PCL prevents the posterior sliding of the tibia (and anterior sliding of the femur) when the knee is flexed. This is very important when walking down stairs or a steep incline [12, 2].

Patellar ligament:

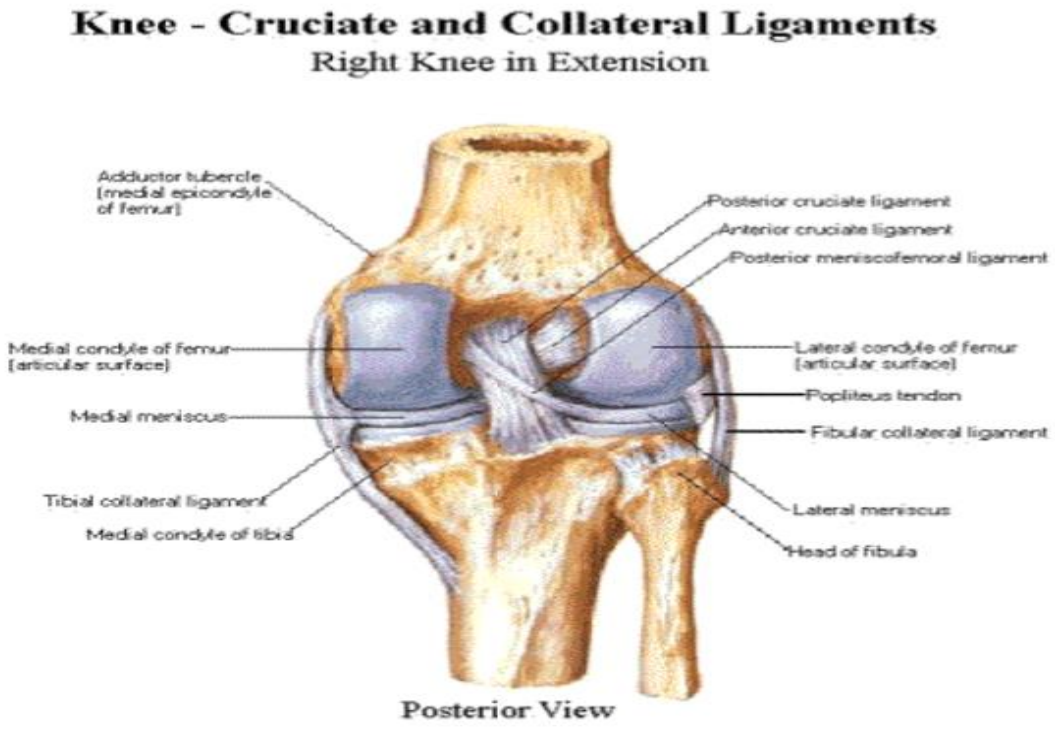
The patellar ligament is basically the continuation of the quadriceps femoris tendon inferior to the patella. It is attached above to the margins and apex of the patella and below to the tibial tuberosity [12, 2].

Collateral ligaments:

The collateral ligaments, one on each side of the joint, stabilize the hinge-like motion of the knee. The cord-like fibular collateral ligament is attached superiorly to the lateral femoral epicondyle just above the groove for the popliteal tendon. Inferiorly, it is attached to a depression on the lateral surface of the fibular head. It is separated from the fibrous membrane by a bursa. The broad and flat tibial collateral ligament is attached by much of its deep surface to the underlying fibrous membrane.

It is anchored superiorly to the medial femoral epicondyle just inferior to the adductor tubercle and descends anteriorly to attach to the medial margin and medial surface

of the tibia above and behind the attachment of sartorius, gracilis, and semitendinosus tendons [12, 2].

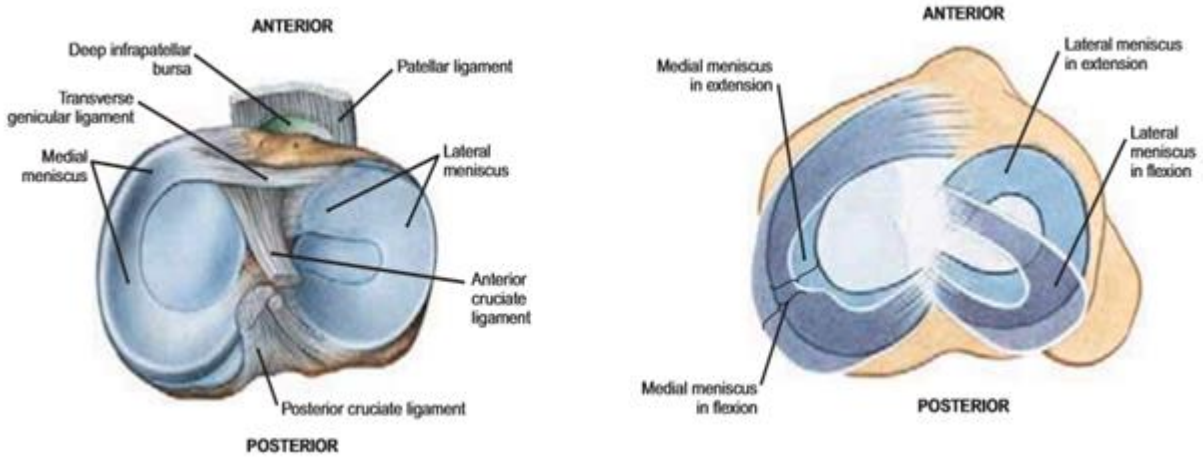


Picture No 3 - Anterior and posterior cruciate and collateral ligament [2].

2.1.3.Menisci of the knee joint

Two fibrocartilage discs between the tibial and femoral condyles help compensate for the irregular shapes of the bones and circulate synovial fluid (pic.4). Semicircular piece of fibrocartilage (C-shaped). Its anterior end is attached to the anterior intercondylar fossa of the tibia, anterior to the anterior cruciate ligament. Its posterior end is attached to the posterior inter- condylar fossa of the tibia between the attachments of the posterior cruciate ligament and lateral meniscus. Lateral meniscus. Nearly circular piece of fibrocartilage (approaches an incomplete O in shape). It is anterior end is attached anteriorly to the intercondylar eminence of the tibia, and laterally and posteriorly to the anterior cruciate ligament. Its posterior end is attached posteriorly to the intercondylar eminence of the tibia, and anteriorly to the posterior end of the medial meniscus. The anterior surfaces of the medial and lateral menisci are connected to each other by the transverse ligament of the

knee and to the margins of the head of the tibia by the coronary ligaments (not illustrated) [12, 2].



A **B**

Picture No 4 - **A**: Condyles of the right tibia, viewed from above: showing the menisci and the attachments on the tibia of the cruciate ligaments. **B**: Superior surface of the right tibial surface showing the locations of the menisci during extension (light blue) and their changes in position during flexion (purple) [12].

2.1.4.Joint Capsule of the knee joint

The joint capsule of the knee joint is typical in consisting of an external fibrous layer of the capsule (fibrous capsule) and an internal synovial membrane that lines all internal sur- faces of the articular cavity not covered with articular cartilage. The fibrous layer has a few thickened parts that make up intrinsic ligaments, but for the main part, it is thin and is actually incomplete in some areas. The fibrous layer attaches to the femur superiorly, just proximal to the articular margins of the condyles. Posteriorly, the fibrous layer encloses the condyles and the intercondylar fossa. The fibrous layer has an opening posterior to the lateral tibial condyle to allow the tendon of the popliteus to pass out of the joint capsule to attach to the tibia. Inferiorly, the fibrous layer attaches to the margin of the superior articular surface (tibial plateau) of the tibia, except where the tendon of the popliteus crosses the bone. The quadriceps tendon, patella, and patellar ligament replace the fibrous layer anteriorly, that is, the fibrous layer is continuous with the lateral and medial margins of these structures, and there is no separate fibrous layer in the region of these

structures. The extensive synovial membrane of the capsule lines all surfaces bounding the articular cavity (the space containing synovial fluid) not covered by articular cartilage [8].

Thus it attaches to the periphery of the articular cartilage covering the femoral and tibial condyles; the posterior surface of the patella; and the edges of the menisci, the fibro-cartilaginous discs between the tibial and the femoral articular surfaces. It lines the internal surface of the fibrous layer laterally and medially, but centrally it becomes separated from the fibrous layer [8].

2.1.5.Muscles around the knee joint

Muscles acting and connecting on the knee joint: (pic.5, 6)

Quadriceps femoris:

The quadriceps femoris muscle is the largest muscle in the body, covering most of the anterior surface and sides of the thigh. The muscle is actually a composite muscle, usually described as four separate muscles: rectus femoris, on the anterior aspect of the thigh, vastus lateralis, on the lateral aspect of the thigh, vastus medialis, on the medial aspect of the thigh and vastus intermedius, located deep to the rectus femoris between the vastus lateralis and vastus medialis. The common tendon for the four muscles is known as the quadriceps tendon, which inserts into the patella. The tendon continues below the patella as the patellar ligament, which attaches to the tibial tuberosity. The quadriceps femoris muscle is the great extensor muscle of the leg [12, 10].

Hamstrings:

The muscles of the posterior (flexor) compartment of the thigh flex the knee. This compartment is composed of three muscles collectively called the hamstrings: biceps femoris, semitendinosus, and semimembranosus. The hamstrings are so named because their tendons are long and string like in the popliteal area [12, 10].

Tensor fasciae late:

This muscle is located on the lateral surface of the thigh. The fascia latae is a layer of deep fascia, composed of dense connective tissue that encircles the entire thigh. It is well

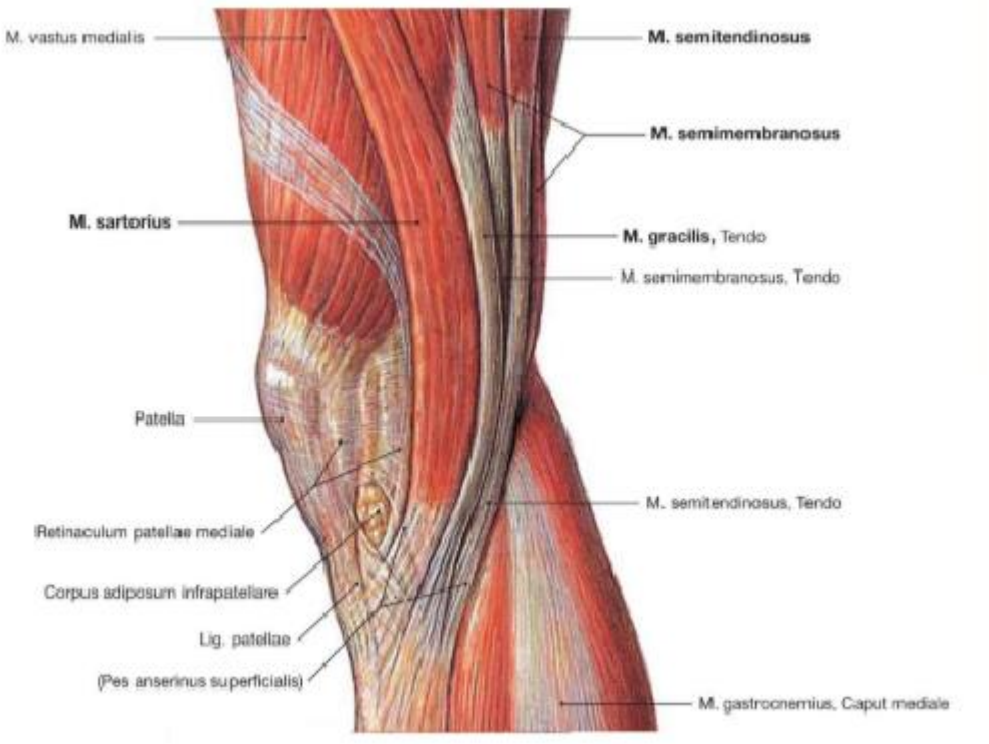
developed laterally where, together with the tendons of the tensor fasciae latae and gluteus maximus muscles, it forms a structure called the iliotibial tract. The tract inserts into the lateral condyle of the tibia. Also is assists on the knee extension [12, 10].

Sartorius:

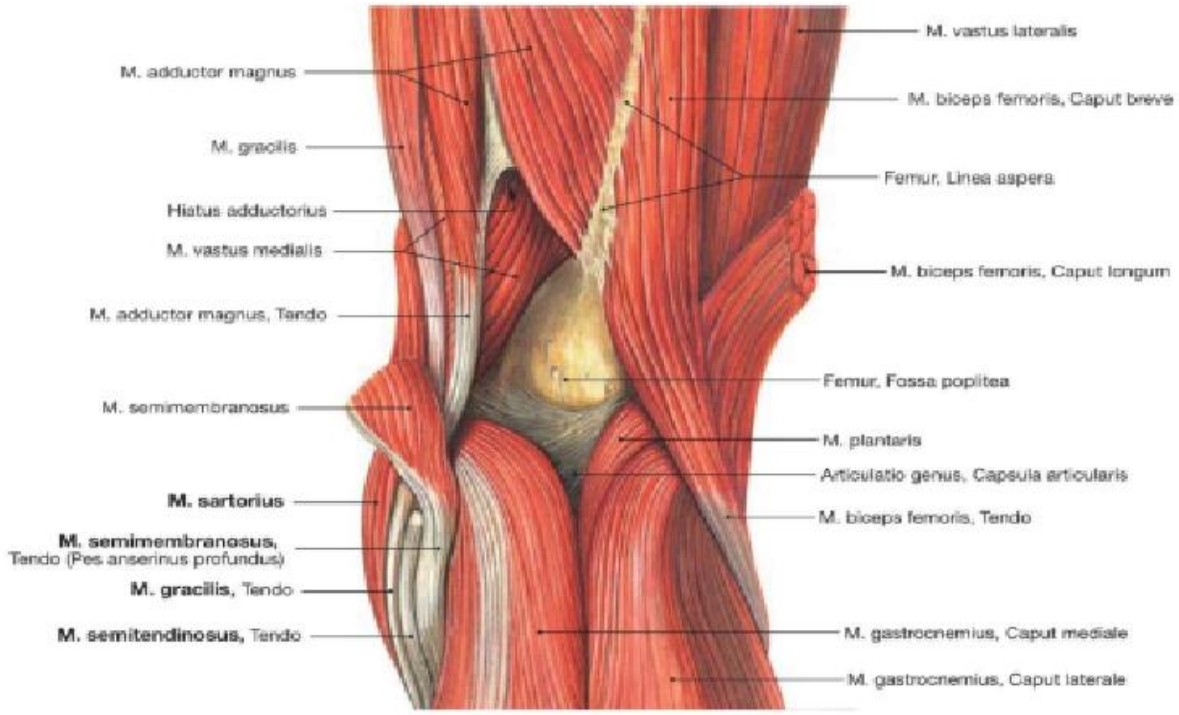
The sartorius is a long, narrow muscle that forms a band across the thigh from the ilium of the hip bone to the medial side of the tibia. The various movements it produces (flexion of the leg at the knee joint and flexion, abduction, and lateral rotation at the hip joint) help effect the cross-legged sitting position in which the heel of one limb is placed on the knee of the opposite limb [12, 10].

Gracilis:

The gracilis, the other muscle in the medial compartment, not only adducts the thigh, but also flexes the leg at the knee joint. For this reason, it is discussed here. The gracilis is a long, strap- like muscle on the medial aspect of the thigh and knee [12, 10].



Picture No 5 - Muscles in the region of the knee joint [10].



Picture No 6 - Muscles in the region of the knee joint, right side, medial and dorsal side [10].

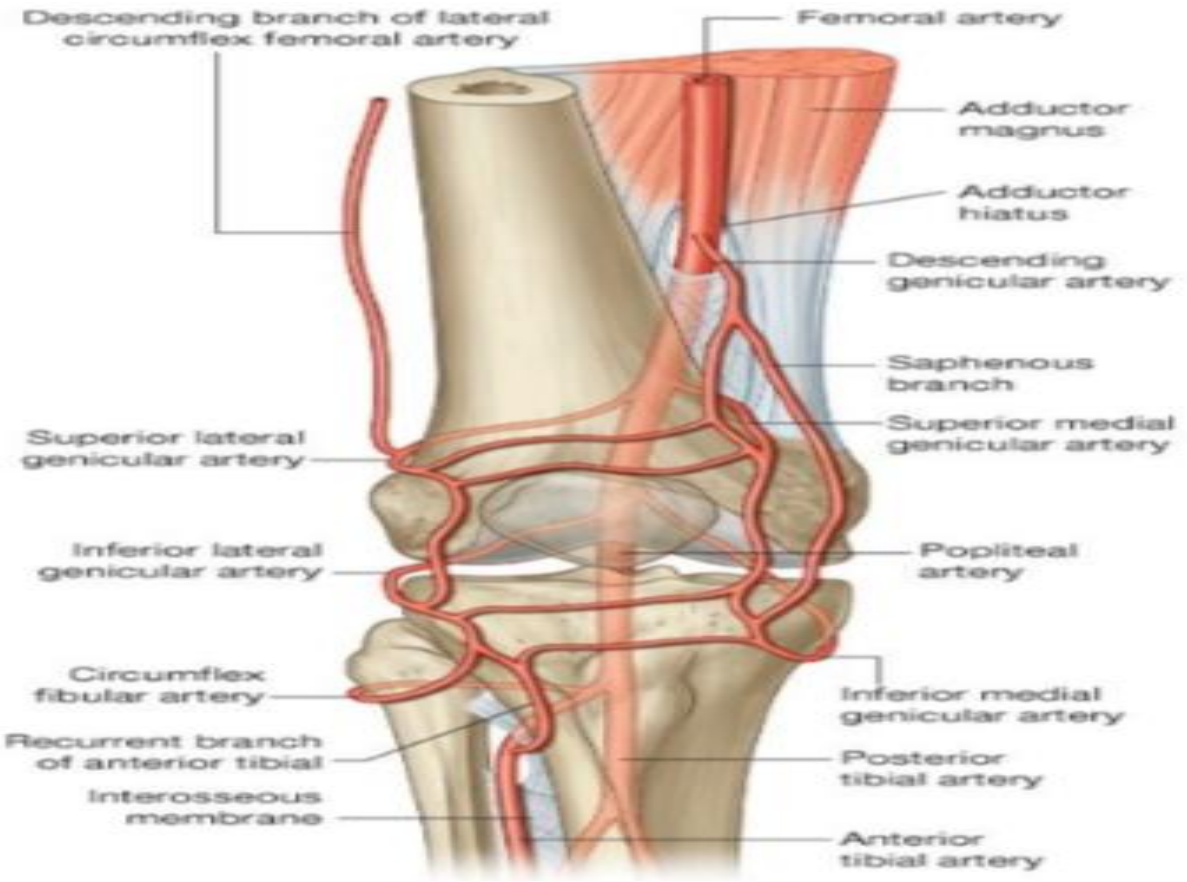
2.1.6.Innervation around the knee joint

The sciatic nerve usually ends at the superior angle of the popliteal fossa by dividing into the tibial and common fibular nerves (pic.7). The tibial nerve and the medial, larger terminal branch of the sciatic nerve derived from anterior divisions of the anterior rami of the L4–S3 spinal nerves. The tibial nerve is the most superficial of the three main central components of the popliteal fossa (nerve, vein, and artery), however, it is still in a deep and protected position. The tibial nerve bisects the fossa as it passes from its superior to its inferior angle. While in the fossa, the tibial nerve gives branches to the soleus, gastrocnemius, plantaris, and popliteus muscles. The common fibular nerve begins at the superior angle of the popliteal fossa and follows closely the medial border of the biceps femoris and its tendon along the superolateral boundary of the fossa. The nerve leaves the fossa by passing superficial to the lateral head of the gastrocnemius and then passes over the posterior aspect of the head of the fibula. The common fibular nerve winds around the neck of the fibula and divides into its terminal branches. The most inferior branches of the posterior cutaneous nerve of the thigh supply the skin that overlies the popliteal fossa [8].

Picture No 7 - Innervation of the lower extremity [11].

2.1.7.Blood supply related to the knee joint

Vascular supply to the knee joint is predominantly through descending and ascending branches from the femoral, popliteal, and lateral circumflex femoral arteries in the thigh and the circumflex fibular artery and recurrent branches from the anterior tibial artery in the leg. These vessels form an anastomotic network around the joint (pic.8) [3, 2].



Picture No 8 - Anastomoses of arteries around the knee. Anterior view [3].

2.2. Biomechanics of the knee joint

The goal of all joints is to allow for motion of the bony segments surrounding the joint while withstanding the loads against gravity imposed by these movements. Biomechanics is defined as the science of the action of forces on the living body. The complex interaction of femur, tibia, and patella allows the knee joint to withstand tremendous forces during normal phases of ambulation. Kinematics is defined as the study of body motion without regard for the cause of that motion.

Six planes of motion exist for the knee: anterior/posterior translation, medial/lateral translation, cephalad/caudad translation, flexion/extension, internal/external rotation, and varus/valgus angulation [6].

The knee joint must provide a normal amount of motion without sacrificing stability during static activities such as standing to more dynamic functions such as walking, jogging, running, pivoting, and ascending or descending stairs. These goals are achieved by

the interaction of the osseous anatomy, articular surface, ligaments, menisci, and surrounding musculature about the knee. Changes in any of these components can alter the biomechanics of the knee joint, greatly increasing the loads and functional demands placed on the remaining structures (pic.9). Understanding the normal interactions of these structures is necessary prior to attempting any reconstructive procedures [6].

2.2.1.Biomechanics of Anterior Cruciate ligament

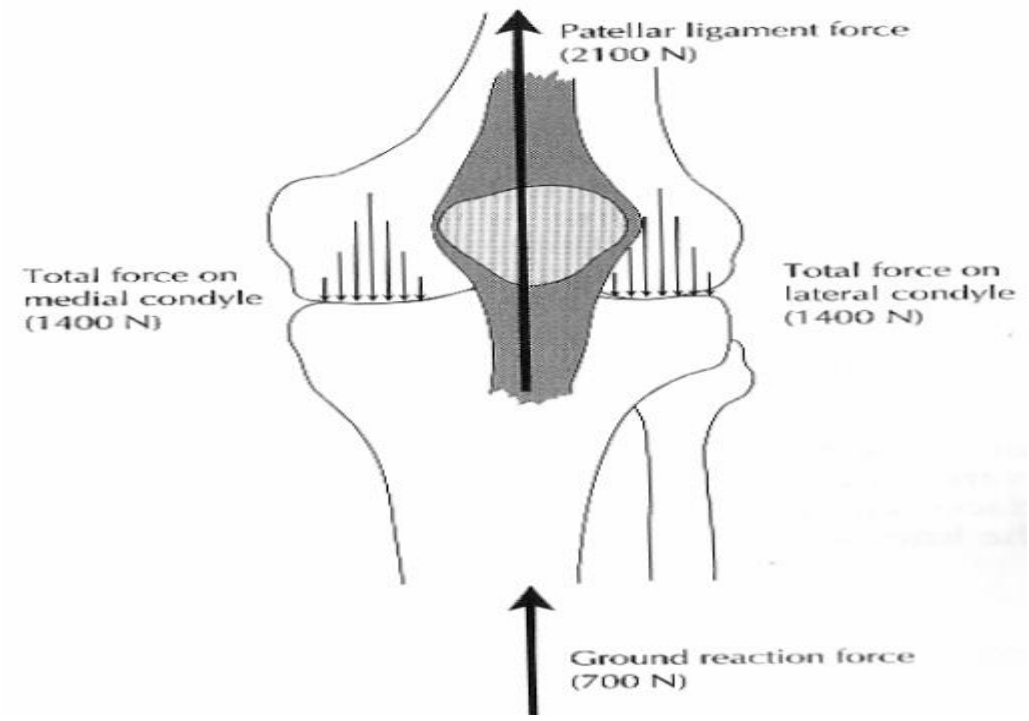
The anterior cruciate ligament is the primary restraint to anterior tibial displacement, accounting for approximately 85% of the resistance to the anterior drawer test when the knee is at 90 degrees of flexion and neutral rotation. Selective sectioning of the anterior cruciate ligament has shown that the anteromedial band is tight in flexion, providing the primary restraint, whereas the posterolateral portion of this ligament is tight in extension. The posterolateral bundle provides the principal resistance for hyperextension. Tension in the anterior cruciate ligament is least at 30 to 40 degrees of knee flexion. The anterior cruciate ligament also functions as a secondary restraint on tibial rotation and varus-valgus angulation at full extension. In vivo, it is an oversimplification to limit the description of anterior cruciate ligament function to the function of its two fiber bundles [1].

In fact, similar to the fibers in all ligaments, those in the anterior cruciate ligament are recruited differently on the basis of every subtle three-dimensional change in the position of the joint. The normal anterior cruciate ligament has been shown to carry loads throughout the entire range of flexion and extension of the knee. Consequently, the anterior cruciate ligament can fail differently at different loads, depending on the position of the bones and the direction in which the loads are applied at the time of injury. The complexities of the arrangement of the ligament fibers and their response to load have important implications regarding the results of tensile tests.

Tensile testing of the anterior cruciate ligament depends on the age of the specimen, angle of knee flexion, direction of tensile loading with respect to the anterior cruciate ligament, and rate of the applied load. In other words, the maximal strength of the anterior cruciate ligament should not be assumed to have one fixed value [1].

2.2.2.Biomechanical factors that contribute to Anterior Cruciate Ligament injuries

Anterior cruciate ligament injury rates tend to be higher for women than for men, at the United States Naval academy, in intercollegiate soccer, basketball, and rugby, women had a relative risk of 4 times of ACL injury compared with men. The National Collegiate Athletic Association Injury Surveillance System (1990-2002) found that the rate of ACL injury, regardless of the mechanism, was significantly higher for female collegiate athletes than for male collegiate athletes in both soccer and basketball. The stronger the quadriceps muscles, the larger and hence stronger the ACL, although it is unclear that in any one individual that an increase in quadriceps size and strength results in an increase in ACL size. Quadriceps muscles, even after adjustments for differences in weight and lean body mass, are larger in male athletes than in female athletes. There are neuromuscular and biomechanical risk factors associated with ACL injury. Compared with running, there is a significant increase in ACL load during sidestepping and crossover cutting maneuvers. This is the result of a large increase in varus/valgus and internal/external rotation movements. These increased stresses during cutting put the ACL at risk, especially when the knee is at flexion angles between 0 and 40 degrees. Appropriate muscle activation strategies may counter these movements [21].



Picture No 9 - Biomechanical contact forces of the knee in standing position [6].

2.3. Kinesiology of the knee joint

The knee joint is a modified as a hinge joint formed by the articulation of the condyles of the femur with the condyles of the tibia, and by the patella articulating with the patellar surface of the femur. Flexion and extension are movements about a coronal axis. Flexion is movement in a posterior direction, approximating the posterior surfaces of the lower leg and thigh. Extension is movement in an anterior direction to a position of straight alignment of the thigh and lower leg (0°). From the position of zero extension, the range of flexion is approximately 140°. The hip joint should be flexed when measuring full knee joint flexion to avoid restriction of motion by the rectus femoris, but the joint should not be fully flexed when measuring knee joint extension to avoid restriction by the hamstring muscles. Hyperextension is an abnormal or unnatural movement beyond the zero position of extension. For the sake of stability in standing, the knee normally is expected to be in a position of only a very few degrees of extension beyond zero. If extended beyond these few degrees, the knee is said to be hyperextended. Lateral rotation and medial rotation are movements about a longitudinal axis. Medial rotation is rotation of the anterior surface of the leg toward the mid-sagittal plane. Lateral rotation is rotation away from the mid-sagittal plane. The extended knee (in zero position) is essentially locked, preventing any rotation [5].

Rotation occurs with flexion, combining movement between the tibia and the menisci as well as between the tibia and the femur. With the thigh fixed, the movement that accompanies flexion is medial rotation of the tibia on the femur. With the leg fixed, the movement that accompanies flex- ion is lateral rotation of the femur on the tibia. With the thigh fixed, the movement that accompanies extension is lateral rotation of the tibia on the femur. With the leg fixed the movement that accompanies extension is medial rotation of the femur on the tibia [5].

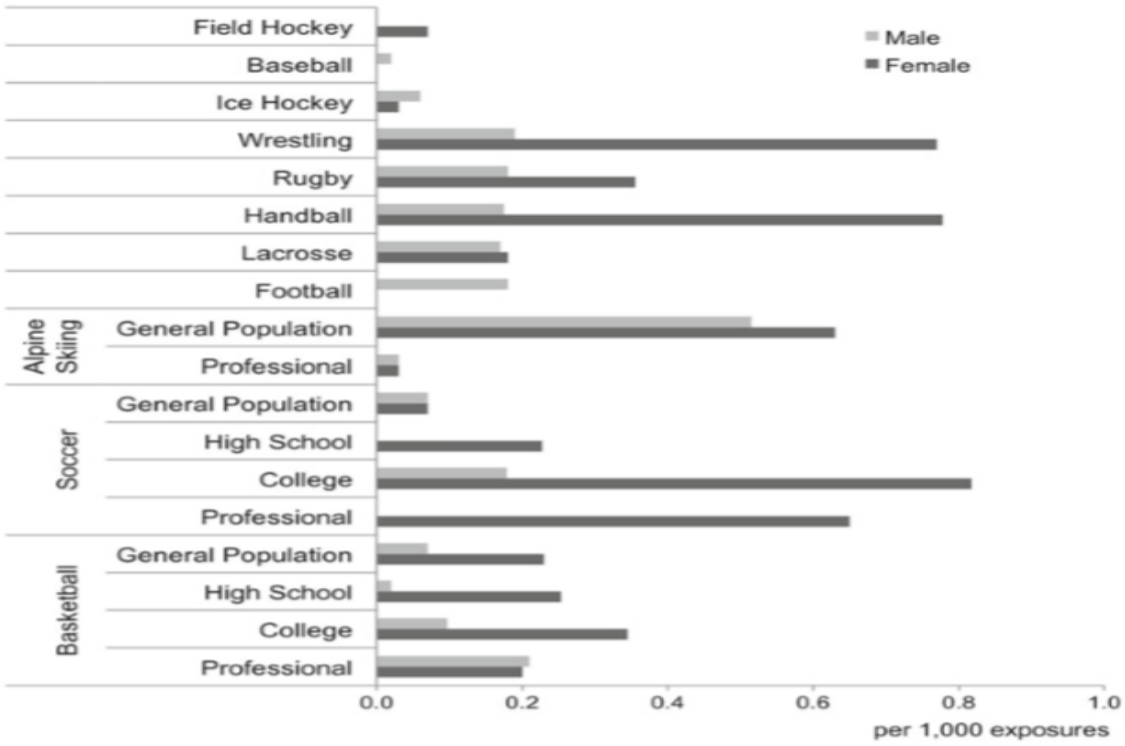
2.4. Anterior Cruciate Ligament Reconstruction

2.4.1.Epidemiology of ACL injury:

In epidemiological studies, this is usually given as incidence, or the number of ACL tears per 1,000 people in 1 year (for all calculations, we assume the United States population is 320 million people). All additional risk factors set aside, current estimates are

that 1–10 in 1,000 people tear their ACL per year. Assuming the current United States population is approximately 320 million, this translates into 32,000–320,000 ACL tears in the USA per year. Others have estimated this number to be as large as 400,000 per year. For comparison, a year has roughly 10,000 hour (8,736 hour), which means there are roughly 3–40 ACL tears per hour in the United States. Official registries from other countries support these numbers: in Scandinavia (population = 25 million), there are two ACL tears every hour and Germany (population = 82 million) and Switzerland (population = 8 million) each have one ACL tear every six minutes and every hour, respectively [9].

Picture No 10 shows the ACL injury rates (per 1,000 exposures) for men and women for specific sports. Typically, the rates of injury in women are higher than the male rates at a ratio of 3:1–8:1, depending on the sport participated in [9].



Picture No 10 - ACL injury rates for men and women [9].

2.4.2.Etiopathogenesis of ACL injury:

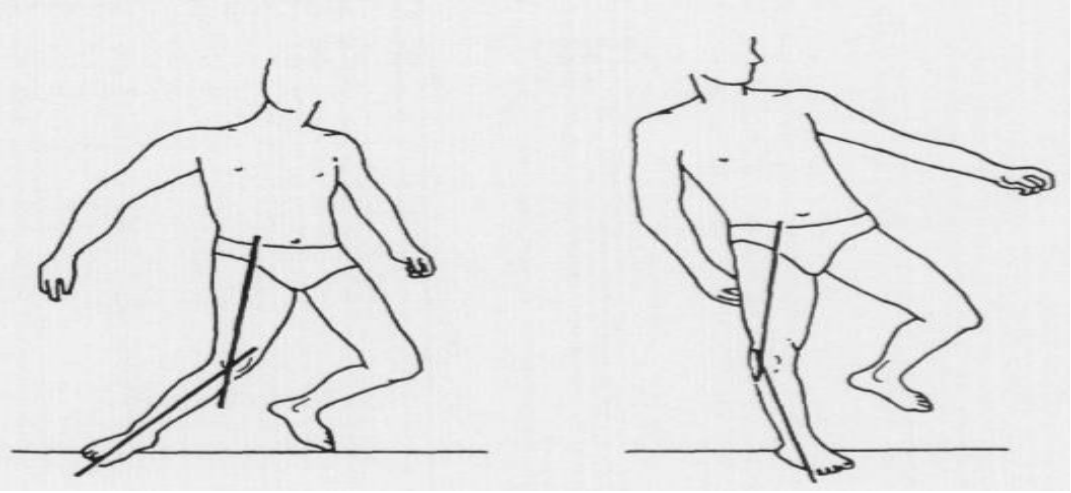
Mechanisms of injury (MOI) causing ACL injury include both contact and noncontact maneuvers. Although the result is basically the same, the biomechanics, pathogenesis, and risk factors vary. The first MOI is through contact injury. Contact-type

mechanisms are preempted by sudden deceleration, abrupt change in direction, hyperextension, and collision while varus or valgus stress is applied to the side of the knee in the form of a shearing mechanism [13].

Contact-type mechanisms often produce injury to multiple structures within the knee. An example is O'Donoghue's Triad - tearing of the ACL, medial collateral ligament, and the medial meniscus. A dipping-type of blunt blow is the culprit in this sliding/tackling maneuver. The other MOI for ACL tears occurs through noncontact type of injury [13].

The motion sequence of noncontact ACL injury is precipitated by an abrupt deceleration or cutting maneuver on a planted foot, internal tibial rotation, and valgus stress. The hip is in extension, the knee flexion angle is 20 degrees to full extension (anterior translation of the tibia is greatest between 0 and 40 degrees of knee flexion), while excessive internal rotation of the tibia occurs at foot strike (see Pic.11).

The body engages in a sharp pivoting motion about a medially fixed planed foot - the body is rotating externally (trying to maintain equilibrium and preventing rotary-axial stress onto the knee). However, anterior shearing of the tibia is occurring, predisposing the meniscus to tearing [13].



Picture No 11 - Mechanism of injury in capsule and ligaments tears of the knee [13].

2.4.3.Pre-operative state of ACL reconstruction:

The time limits classifying ACL injuries into acute, subacute and chronic are vague and there is no consensus regarding the optimum timing of an ACL reconstruction. Acute reconstruction' implies variations between days to weeks after the injury. Subacute could

mean several months and chronic from three months to more than a year after the injury. In this context, strict definitions of timing may be difficult because of individual biological variations in terms of muscle strength, range of motion, pain and effusion. Approximately 20-30 years ago, it was customary to perform the ACL repair/reconstruction within days, in most cases within the first week after injury, as this was believed to be correct, without any real scientific basis. Many of these patients developed post-operative arthrofibrosis with reduced of ROM. Indeed, the loss of extension is often more devastating for the patient than the functional instability. Some researchers have mentioned that early ACL reconstruction after the acute phase might lead to more normal knee laxity and less risk of meniscal and cartilage damage [14].

Given fewer problems with secondary meniscal and cartilage damage, the risk of osteoarthritis in the long run should also be less. Shelbourne and Patel stated that, if the patient had good (normal) range of motion, little swelling, good leg control and a stable mental state before surgery, a predictable, smooth post-operative course could be expected. It thus appears that the time interval from the ACL injury is less important than the condition of the knee at the time of surgery. ROM, effusion and pain are probably most important. There is no optimum time at which the ACL reconstruction should be preferably performed, nor is there any corresponding period when it should not [14].

2.4.4.Post-operative state of ACL reconstruction:

A well-planned and supervised post-operative rehabilitation protocol is probably as important for the final outcome after ACL reconstruction as the surgery itself. Early joint motion is also beneficial when it comes to avoiding capsular contractions and reducing swelling and pain, to avoid arthrofibrosis. Post-operative immobilization of the knee may contribute to limited range of motion, muscular hypotrophy and inferior knee function. Rehabilitation protocols aim to restore the normal range of motion, muscle strength, co-ordination and full function as soon as possible, without damaging the graft [14].

2.4.5.Solutions of damages of ACL- Types of grafts:

Patellar tendon graft:

Use of the patellar bone-tendon-bone graft has been a popular choice for ACL reconstruction for over two decades and it remains widely used. In this procedure, a 9-11 mm wide strip of tendon is harvested from the centre of the patellar tendon through a vertical incision, or two small horizontal incisions. During harvesting, 2-2.5 cm long bone blocks are retained attached to the harvested tendon. These bone blocks can then be inserted into tunnels drilled in the femur and tibia at the sites where the normal ACL inserts. Then, they are locked in place, usually by bio absorbable screws [19].

Hamstrings and gracilis tendon graft:

There are several different surgical procedures documented for use of hamstring tendon grafts for ACL reconstruction. In most procedures, the tendon of the semitendinosus muscle is used, either alone, or in addition to the gracilis tendon.

In a procedure that is now commonly used, both semitendinosus and gracilis tendons are harvested and are doubled up giving a 4 fiber construct. Harvesting is achieved through a small incision close to pes anserinus on the medial aspect of the proximal tibia. As with the patellar tendon graft, the hamstring grafts are inserted into tunnels drilled in the tibia and femur. There are various methods for attachment of the graft including metal or bioresorbable screws, sutures and the inner button. This operation is technically more demanding and requires surgical experience as muscle or nerve damage can occur in the harvesting technique and harvested tendons must be prepared and tensioned prior to implantation in the knee. Double or quadruple hamstring tendon grafts have the added theoretical advantage of forming a multi-band structure to more closely replicate the two bands of the ACL [19].

2.4.6.Indication of ACL reconstruction:

First, a randomized control trial by Sandberg et al, was found primary repair of the ACL to be no better than non-operative treatment. Second, in the 1990s, patellar tendon ACL reconstruction was found to be better than ACL suture repair and ACL augmentation [9].

Third, ACL surgery was also determined to result in a significant decrease in the rate of meniscal tears from 32 % in a non-operative group to 3 % in a surgical group. Fourth, the recently published knee, anterior cruciate ligament, non-surgical versus surgical treatment randomized control trial looked at early ACL reconstruction versus rehabilitation with possible late ACL reconstruction. This study was with patients 18–35 years old from Lund, Sweden. They included 44 % of the ACL tears that were presented to physicians during that period of time, 56 % were excluded due to age, activity, chronic injury, prior surgery, or collateral ligament injury. Their primary outcome measure was the Knee Osteoarthritis Outcome Score at 2 years after the injury. During the first 2 years of the study, 37 % (23/59) of the patients that were initially assigned to the non- operative group opted for delayed ACL reconstruction. Thirty-six percent of the rehab patients also exhibited signs, symptoms of a meniscal tear. Intention-to-treat analysis (where the results are reported for each group of patients as they were assigned at the beginning of the study, the patients who later opted for ACL reconstruction were still included in the results for the non-operative group) showed the same patient-reported outcomes at 2 years. However, 37 % of the rehabilitation patients had opted for ACL reconstruction by this time.

These patients are still being followed by the same research group, and whether the high rate of meniscal loss in the non-operative group will significantly affect the longer-term outcomes remains to be seen [9].

2.4.7.Clinical image of ACL reconstruction:

Clinical tests such as the angle reproduction test, posturography, and gait analysis revealed pathological changes after ACL rupture. Hogervorst and Brand 1998, Jerosch and Prymka 1996, despite successful ACL surgery with patients report, for example, symptoms of knee instability and complain of a feeling of “giving way” that may arise from loss of proprioception and altered stretch reflex excitability. There are, however, also patients who have mechanical instability (no surgery) but no “giving way” symptoms. In addition, it is still unclear whether the “giving way” phenomenon is associated with mechanical knee instability [17].

Beard et al. (1994) and Bruhn (1999) mechanically induced posterioranterior tibial translation in patients with ACL rupture during standing and reported a significant increase

in the latency of the ACL–hamstring reflex. These studies and that of Wojtys et al. (1994) for the first time provided evidence for the presence of altered stretch reflex excitability [17].

2.5. Examination procedures

2.5.1.Physician's diagnostic examination:

To evaluate possible rupture of the anterior cruciate ligament (ACL), family physicians rely on the history and physical examination and primarily 3 diagnostic assessments: the anterior drawer test, the Lachman test, and the pivot shift test. Preliminary findings from these tests, coupled with patient preference and physical demands, help select those who may need further work-up with arthroscopy or magnetic resonance imaging [20].

2.5.2.Anterior drawer test:

Although the anterior drawer test has been widely used in the diagnosis of ACL ruptures, its origin remains obscure. According to Paessler and Michel, Paul Segund described, as early as 1879, the "abnormal anterior- posterior mobility" of the knee that is associated with ACL ruptures.

George Noulis, who Paessler and Michel credited with the earliest description of what we now call the Lachman test, also explained the drawer tests in large degrees of flexion (knee flexion 90°). In a translation of Noulis's 1875 thesis, published in the textbook Diagnostic Evaluation of the Knee, by Strobel et al. Noulis describes the following test: With the patient's leg flexed, the thigh can be grasped with one hand at the lower leg with the other hand keeping the thumbs to the front and fingers to the back. If the lower leg is held in this grip and then moved backwards and forwards, it will be seen that the tibia can be moved directly backwards and forwards. Noulis observed a great deal of tibia displacement when both cruciate ligaments were severed. The assumption that a positive anterior drawer test indicates a tear of the ACL was not commonly accepted until much later. Increased anterior tibial displacement, when compared with the uninvolved side, is now supported as indicative of an ACL tear [16].

2.5.3.Lachman test:

The Lachman test was described by Torg et al, who trained under Lachman at Temple University. Interestingly, Paessler and Michel traced descriptions of what we now call the Lachman test to Noulis's 1875 thesis. Despite these very early descriptions, the test was not widely recognized or used until Torg's classic description of the Lachman test, which is given below: The examination is performed with the patient lying supine on the Table No with the involved extremity on the side of the examiner. With the patient's knee held between full extension and 15 degrees of flexion, the femur is stabilized with one hand while firm pressure is applied to the posterior aspect of the proximal tibia in an attempt to translate it anteriorly. A positive test indicating disruption of the anterior of cruciate ligament is one in which there is proprioceptive and/or visual anterior translation of the tibia in relation to the femur with a characteristic "mushy" or "soft" end point. This is in contrast to a definite "hard" end point elicited when the anterior cruciate ligament is intact [16].

2.5.4.Pivot shift test:

The pivot shift is both a clinical phenomenon that results in a complaint of a giving way of the knee and a physical sign than can be elicited on examination of the injured knee. Hey Groves in 1920 and Palmer in 1938 published photographs showing patients voluntarily producing what is now called the pivot shift phenomenon. The phenomenon was characterized as an anterior subluxation of the lateral tibial plateau in relation to the femoral condyle when the knee approaches extension with reduction produced with knee flexion. The pivot shift is enhanced by the convexity of the tibial plateau in the sagittal plane. The pivot shift test was initially described as follows: The leg is picked up at the ankle with one of the examiner's hands, and if the patient is holding the leg in extension, the knee is flexed by placing the heel of the other hand behind the fibula over the lateral head of the gastrocnemius. As the knee is extended, the tibia is supported on the lateral side with a slight valgus strain applied to it. In fact, this subluxation can be slightly increased by subtly internally rotating the tibia, with the hand that is cradling the foot and ankle [16].

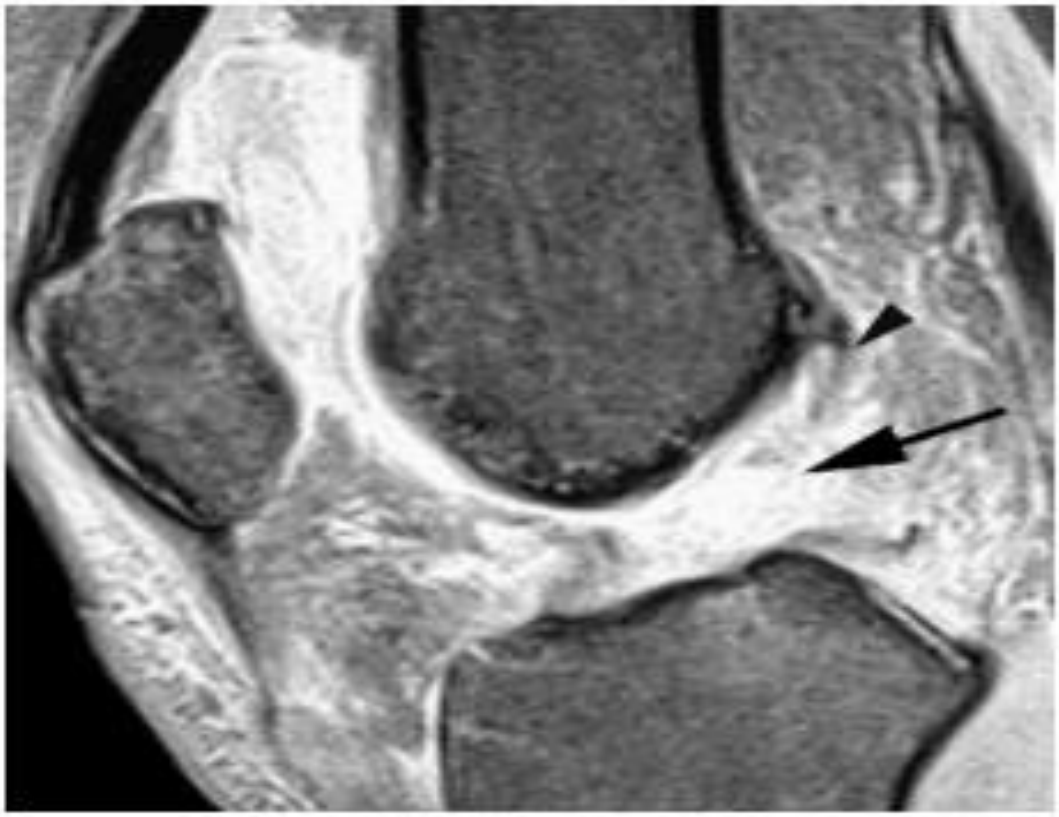
A strong valgus force is placed on the knee by the upper hand. This impinges the subluxed tibial plateau against the lateral femoral condyle, jamming the two joint surfaces

together, preventing easy reduction as the tibia is flexed on the femur. At approximately 30 degrees of flexion, and occasionally more, the displaced tibial plateau will suddenly reduce in a dramatic fashion. At this point, the patient will jump and exclaim [16].

2.5.5.Magnetic resonance imaging of ACL reconstruction:

MRI scanning of the knee joint is routinely prescribed as the initial non-invasive diagnosis tool after clinical examination, which can include the “anterior drawer test “and “Lachman test”. MR Imaging is the method of choice to further evaluate additional knee injuries that may accompany an ACL tear (pic.12). Despite at a clinically flawless MR exam, the images can be difficult to interpret and are observer dependent. Because of the so issues, false negative diagnostic findings are to be expected in up to 20% of patients regardless of the experience of the examiner. This is mainly the case in the diagnosis of injuries to the cruciate ligament and to the meniscus and possible sources of error may vary. It has been reported that MR imaging the knee during flexion may permit better visualization of the ACL [18].

MRI of the knee has been a clinical tool for twenty years and has been widely available in developed countries for fifteen years. The sensitivity and specificity of knee MRI for ACL injury is high, with sensitivities and specificities of 90-95% and 95-100% respectively quoted in the literature. The role that MRI plays in the diagnostic algorithm varies from clinician to clinician, often owing to the accuracy of clinical examination. In the UK it is not common practice to perform MRI in suspected acute ACL tears but anecdotally this practice is increasing in prevalence. In patients with major knee trauma, in whom the knee is very swollen and the plain radiographs are normal, MRI may significantly contribute to the management of the patient. Although, for most patients, an ACL tear does not need to be reconstructed in the acute setting, associated injuries such as trabecular fractures, peripheral meniscal or collateral ligaments tears, or capsular ruptures may alter the immediate management [15].



Picture No 12 - Sagittal gradient echo MRI demonstrating high signal replacement of the ACL (arrow) in a complete tear. The proximal ACL remnant can be seen falling away from Blumensaat's line (arrowhead) [15].

2.5.6.Physiotherapeutic examination:

The physiotherapist must apply the followed examination to collects as much quality information, before the therapy progress:

2.5.7.Anamnesis-Past history

Past history of the patient from the physiotherapeutic view is very important for his next work and of course well done past physiatric history is more than half well done diagnosis. A physiotherapist must take anamnesis every time when he will work with a new patient. During the examination the physiotherapist must closely observe the patient's body language, attitude and social awareness. The physiotherapist must collect the history in a professional level, but be careful and sensitive manner. The physiotherapist has to ask

specifics questions to obtain all the necessary information but the patient must be able to answer these questions freely [22].

The patient must feel also comfortable so they can discuss everything about the problem without missed any important information [22].

2.5.8.Posture examination:

According the posture examination the physiotherapist can examine the patient in standing position. The patient must examined from the anterior, posterior and lateral view. In the anterior viw the examiner observe the position of the feet, knees, and legs. Toe positions, appearance of the longitudinal arch, alignment in regard to pronation or supination of the foot, rotation of the femur as indicated by position of the patella, knock-knees, or bowlegs should be noted. Any rotation of the head or abnormal appearance of the ribs should also be noted. In the lateral viw the physiotherapist must observed from both the right and left sides for the purpose of detecting rotation faults. Descriptions such as the following may be used in recording findings: "Body anterior from ankles up," "Pelvis and head anterior," "Good except lordosis," or "Upper trunk and head posterior. In the posterior view the physiotherapist should note the alignment of the tendo calcaneus, postural adduction or abduction of the hips, relative height of the posterior iliac spines, lateral pelvic tilt, lateral deviations of the spine and positions of the shoulders and the scapulae [5].

2.5.9.Anthropometric measurament examination:

In this examination the physiotherapist can measure the height, the length and the circumfernce of the whole upper and lower extremity. The physotherapist must take all the measuraments in a relaxed position (lying, for the upper extremity also sitting or standing). The measuring tape is placed on the skin where are projected particular points of the skeleton. Some other measuraments are circumfernce of the head, thorax, waist and hips [23].

2.5.10. Gait examination:

Very important examination of walking. During this examination the patient must be without clothes and shoes so the physiotherapist can regognise any abnormal gait. Walking examination provided by the patient in the following types: walk forward, walk backwards (m.glutaeus maximus), walk with she or he hands overhead (m.glutaeus medius, minimus), walk with eyes closed (quality of proprioception), walk up the stairs, walk over obstacles in the terrain, walk with crutches, walking rhythm (periodic, non periodic), walking speed and distance, stride length (short steps/long steps), axial position of the lower limb (knock knee, flatfoot, coxa valga/vara), feet from the ground motion (movement of the ankel, heel, toe), movement of center of gravity, movements of the hands, head and trunk, stability of walking [26].

2.5.11. Palpation- muscle tone examination:

Palpation is extremely important in the diagnosis of painful structures of the locomotor system and essential for all manipulative techniques. This examination therefore follows next, immediately after the inspection. The first step in palpation is to place a hand (finger) onto the surface of the patient's body and then to focus one's attention on the aspect to be tested: warmth, moisture, consistency (whether the surface is rough or smooth), mechanical properties (resistance, mobility, stretch capacity), and whether the examination causes the patient to feel pain. Given that palpation is associated with touch and this in turn with pressure, we might think that an objective way to perform it would be to use a pressure gauge. Sadly this is misleading; palpation is never a matter of mere (static) pressure, but a process that involves movement of the hand (fingers) [7].

Muscle tone examination provides as palpation in the each muscle in the direction of the fibers. During the examination the physiotherapist must feel the tone of the muscle if it is high tone (hypertone), normal tone (Eutone) or low tone (hypotone). Also myofascial trigger points can be found under palpation especially on hypertone and hypotone muscles [7].

2.5.12. Soft tissue examination:

The physiotherapist must examine the restriction of the skin, subskin and the fascia of the thigh and calf because after the ACL reconstruction is usually appears restricted. The examination performe with waving techniques in the restricted direction of the thight and calf [7].

2.5.13. Goniometry examination:

In physical therapy a goniometer is an instrument which measures an axis and range of motion. If a patient experiences decreased range of motion in a joint (e.g. a knee), the therapist can use a goniometer to assess what the range of motion is prior to intervention, and then make sure the intervention is working by using the goniometer in subsequent interventions. Measuring of range of active or passive movement or angle of segments in case of ankylosis. The physiotherapist can measuring ROM in one plane and one pacient is important measuring with the same goniometer. The values are rounded up to 5 degrees [24].

The physiological ROM of knee flexion is 125-160 degrees and the physiological knee extension is 0-10 degrees [24].

2.5.14. Muscle strength test examination:

The examiner stabilizes the proximal part in tests of finger, wrist, toe and foot muscles, but in other tests, the body weight should help to stabilize the proximal part. Muscles that have an antagonistic action give fixation by preventing excessive joint movement. We call them the fixation muscles. In muscle testing, weakness must be distinguished from restriction of ROM. Frequently a muscle cannot complete the normal ROM. It may be that the muscle is too weak to complete the movement, or it may be that the ROM is restricted because of shortness of the muscles. In manual muscle testing, grading is based on a system in which the ability to hold the tested part in a given position against gravity establishes a grade referred to as fair or the numerical equivalent. For grades above fair, pressure is applied in addition to the resistance offered by gravity [25].

A description of the Lovett system was published in 1932 and listed the following definitions of the muscle grading:

Gone = no contraction felt.

Trace = muscle can be felt to tighten but cannot produce movement.

Poor = produces movement with gravity eliminated but cannot function against gravity.

Fair = can raise the part against gravity.

Good = can raise the part against outside resistance as well as against gravity.

Normal = can overcome a greater amount of resistance than a good muscle [25].

2.5.15. Muscle length test examination:

Muscle length test consists of movement that increase the distance between origin and insertion, elongating muscle in direction opposite to the muscle actions. The physiotherapist must maintain standard testing position, fixation and direction of movement. Also therapist must apply constant pressure throughout whole procedure. Accurate muscle length testing usually requires that the bone of origin be in a fixed position while the bone of insertion moves in the direction of lengthening the muscle. Length tests use passive or active-assisted movements to determine the extent to which a muscle can be elongated [5].

2.5.16. Joint play examination:

The objective of manipulation is to restore normal mobility to joints, including joint play. By examining and comparing the joint play movements between the two sides, the therapist is able to distinguish whether there is a blockage or not in the target joint. The position adopted by the practitioner relative to the patient is in many ways decisive for the technique that is to be used. If the practitioner is not relaxed, the patient too will be unable to relax. When treatment movements are performed correct the practitioner's hand and forearm always form an extension of the direction of motion. The patient should lie or sit in such a way as to be relaxed. The patient's lying or sitting position should be selected so that the joint to be treated is ideally centered, allowing maximal muscle facilitation and relaxation. The joint that is the object of treatment must be accessible, and one of the articulating bones should be fixed either by the patient's own position or by the practitioner. When techniques are performed correctly, one of the bones articulating in the joint being manipulated is fixed while the other is mobilized. In extremity joints it is

usually the proximal bone that is fixed, that is supported by the body of the practitioner or by the treatment. For effective fixation the mobilizing force should not act across two joints. In this process the practitioner's hands are close (but not too close) to the joint so as to avoid any lever action [7].

2.5.17. Movement pattern examination:

The principle of the basic movement pattern is to evaluate the co-ordination and the sequence of muscle groups and not the muscle power.

Rules to provide the basic movement pattern:

1. Slow movement should be done, because requires high level of co-ordination.
2. No correction should be done by the therapist the time that the active movement is done.
3. No contact should be done to the patient, because we can facilitate the muscles.

Causes of pathological basic movement pattern:

1. Defensive mechanism to some irritation.
2. Bad positions during life-style can modify the basic movement pattern [4].

2.5.18. Rehabilitation of ACL:

Phase 1: Immediate postoperative phase through 6 weeks

Goals:

- Protect the graft fixation (8 weeks)
- Minimize the effects of immobilization
- Control inflammation and swelling
- Immediate full knee passive extension
- Quadriceps activation
- Patient education

Brace:

- Week: Locked in full extension for weight bearing and sleeping
- 1-6 Week: Unlocked For Ambulation, Remove For Sleeping

Therapeutic exercises:

- Gentle heel slides

- Quadriceps setting
- Patellar mobilization
- Non-weight baring gastrocnemius and soleus stretching
- Quadriceps isometrics at 60 and 90 degrees
- Gluteal setting
- Weight shifting
- Static balance exercises
- Heel raises- bilateral progressing to unilateral

Clinical Milestones:

- Full knee extension
- No limp or pain during gait
- 90 degrees of knee flexion
- No signs of active inflammation
- No increased effusion or edema
- No increased pain

[27]

Phase 2: Intermediate phase (6-8 weeks)

Goals:

- Restore normal gait
- Maintain full knee extension
- Progress flexion ROM
- Protect graft
- Initiate open kinetic-chain exercises

Therapeutic exercise:

- Wall slides 0-45 degrees, progressing to mini-squat
- Multi-hip (4 way) machine
- Stationary bicycling (high seat, low tension promoting ROM)
- Closed-chain terminal extension with resistive tubing or weight machine
- Heel raises

- Balance exercises(e.g., single leg balance)
- Hamstrings curls
- Aquatic therapy with emphasis on mobilization of gait
- Continue hamstrings stretches, progress to weight-bearing gastrocnemius and soleus stretches.

Clinical Milestones:

- Maximize ROM
- Good quadriceps recruitment
- Maintenance of full passive knee extension

[27]

Phase 3: Advanced strengthening (8weeks-6 months)

Goals:

- Full ROM
- Improve strength, endurance and proprioception of lower extremity to prepare for full functional activities
- Avoid overstressing grafts or graft fixation
- Protect patellofemoral joint

Therapeutic exercises:

- Continue flexibility exercises as appropriate
- Stair master: begin short steps, avoid knee hyperextension
- Nordic track knee extension: 90-45 degrees of the knee flexion
- Advance closed kinetic-chain strengthening (single leg squats, leg press 0-45 degrees, step-ups begin at 2 inches progressing to 9 inches)
- Progress proprioceptive activities (slide board, use of ball, racquet with balance activities)
- Progress aquatic program to include pool running, swimming (no breast stroke)

Criteria for advancement:

- Full ROM
- Full pain-free
- No evidence of patellofemoral joint irritation
- Strength and proprioception approximately 70% of uninvolved leg
- Physician clearance to initiate advance closed kinetic-chain exercises and functional progression

[27]

Phase 4: Return to activity (9 months and +)

- Safe returns to athletics
- Maintenance program for strength and endurance
- Physician may recommend a functional brace for use during sport for the first 1-2 years after surgery

[27]

3. SPECIAL PART (CASE STUDY)

3.1. Methodology

The clinical work practice was done in Ústřední Vojenská Nemocnice in Prague. It started on Monday 3rd of February 2014 and finished on Friday 14th of February 2014. Each day had the duration of eight hours. The total amount of the hours of my practice was eighty.

My clinical work placement was supervised by Dis. Petr Smejkal. My patient was one day after Anterior Cruciate Ligament (ACL) surgery in right knee. The numbers of sessions with my patient were five. They started on Monday 3rd of February 2014 and they continued day to day until 8th of February 2013. All the sessions were in the orthopedic department in the patient's room during the staying in the hospital in the same time.

The therapeutic procedures that I used were mostly manual therapy which took place in an individual therapy. I used mostly my hands for the therapeutic procedures, however I used also soft balls for some exercises and Continues Passive Motion machine. Some instruments such as goniometer, measurement tape, neurological hammer, and plumb line were used for the examination procedures. The patient was using crutches for walking, in all therapeutic sessions.

The patient was fully aware of the examination and therapeutic procedures at all given times. There were no invasive methods used and there was a consent form signed between me and the patient.

My clinical practice has been approved by the Ethics Board Committee of the Faculty of Sport and Physical Education at Charles University, under the approval number 104/2014

3.2. Anamnesis:

Examined person: J.E. (Female)

Date of birth: 1990

Diagnosis: Anterior Cruciate Ligament surgery of the right knee

3.2.1. Present state:

The patient had ACL operation on the right knee on 3rd of February 2014 at Ústřední Vojenská Nemocnice in Prague. Today 4th of February she feels very good. The graft was taken from patellar tendon. The level of the pain is normal after taking painkillers in the morning. She is resting on her room at the bed. Her condition now is absolutely good. For today because is the first day after operation, the doctor indicates that she must stay at the bed for the whole day with not any loading of her knee. Her right leg is bandaged from the foot until 10cm above the knee for the first day only. She has also blood drainage in her right knee for the removing waste blood products. Her psychological condition is good but not the best because she is a sport girl and she does not accept that she is staying injure a lot of time on the bed.

Height: 155 cm

Weight: 45 kg

BMI: 19kg/m^2

Pain level: 5/10 *[scale from 1(minimum) to 10(maximum)] (*painkillers in the morning- now it is one hour after)

3.2.2. Family anamnesis:

Nobody of her parents had similar injury. Her parents are absolutely healthy.

3.2.3. Personal anamnesis:

The patient is a player in team of freespeed, and she was challenging in an ultimate freespeed league with her team. Before 5 months, while she was playing she did a bad movement as an over rotation of the right knee. She felt a terrible pain on her right knee and she stopped the game. She did not go to the hospital immediately after the accident and she went the following day of the accident to the doctor. The doctor diagnosed that she

totally cut her Anterior Cruciate Ligament of her right knee. The patient had the operation 5 months after the accident. During this period of 5 months the patient used ice for the first days, rest at home and avoids all the activities.

3.2.4. Social anamnesis:

Living in dormitory, 2nd floor using the elevator

3.2.5. Occupational anamnesis:

She is student of economics

3.2.6. Operation anamnesis:

Remove her tonsils when she was 5 years old

3.2.7. Pharmacological anamnesis:

Painkillers to decrease pain

3.2.8. Hobbies:

Ultimate freespeed Czech Republic league

3.2.9. Allergies:

None

3.2.10. Gynecological anamnesis:

Physiological with no problems

3.2.11. Previous injuries or traumas:

None

3.2.12. Abuses:

No smoking, drinking alcohol occasionally.

3.2.13. Previous rehabilitation:

None

3.2.14. Statement from the patient's medical documentation:

None

3.2.15. Differential diagnosis:

I supposed that the patient will have structural and functional changes.

Structural changes:

From the accident, the patient could cut her cruciate ligaments, also there was a risk of damage of meniscus in the knee joint. There was a risk of dislocation of the patella. From the operation I suppose that the anterior cruciate ligament is now recovered and the structural of the knee joint is physiological but swelling and pain can be present.

Functional changes:

Weakness of muscles (biceps femoris, quadriceps, tensor fascia late, adductors, triceps surae) around the knee joint and hip can be presented. Also hypertonicity of muscles (biceps femoris, quadriceps, tensor fascia late, adductors, and triceps surae) around of knee and hip joint can be presented. The patient can have pain around the knee joint and restriction of the flexion of the right knee due to the operation. Joint play of the peripheral joints can be limited in tibiofibular joint, talocrural joint, chopart and lisfranc joint, metatarsophalangeals joints and sacroiliac joint. Position of the pelvis can be changed (anterior - posterior tilt, lateral tilt or torsion). Postural of the whole trunk can be change due to the operated knee joint. Due to the change of the biomechanics of the right knee and the lower extremity after the operation the function of the spine can be influenced.

3.2.16. Indication of rehabilitation:

Reduce pain, soft tissue techniques, increase range of motion, mobilization of peripheral joints, post isometric relaxation for hypertonic muscles (quadriceps, abductors, adductors, hip flexors, gluteus, hamstrings, gastrocnemius and soleus) if are presented, active and passive movements, strengthening exercises (isometrics), continuous passive

motion machine, education of walking with crutches 3-point normally and on stairs and education with weigh loading (at first 80% healthy leg- 20% operated) and education of verticalization of the bed.

3.2.17. Subjective feeling of the patient:

The patient feels pain on her right knee. Generally her condition is good.

3.3. Initial Kinesiological Examination

1. Postural examination
2. Anthropometry measurement
3. Gait examination
4. Palpation
5. Soft tissue examination
6. ROM examination
7. Muscle strength test
8. Muscle length test
9. Joint play examination
10. Movement pattern examination
11. Neurological examination

3.3.1. Postural examination (with crutches):

*The examination was performed with crutches on the 2nd day after the surgery when the patient was able to stand with crutches after the instruction of her doctor.

Posterior view:

- Short base of standing
- Standing on the lateral aspect of the foot on the operated (right) leg
- The volume of right calf is bigger than the left
- Slight valgosity of both knees
- The right popliteal line of the right knee is higher

- The volume of the right thigh is bigger than the left
- Scoliosis concave to the left side in lower thoracic and lumbar spine
- Flat cervical spine
- The left shoulder is slight higher than the right
- Head is in the midline

Side view:

- Ankles are in right alignment
- Slight hyperextension of the left knee (due to the more loading on this leg)
- Slight anterior tilt of pelvis
- Flat cervical spine
- Shoulders are protracted
- Head is forward and protracted

Anterior view:

- Short base of standing
- The volume of the right knee is bigger
- The volume of the right thigh bigger
- Umbilicus is in midline
- Whole trunk is leans to the left
- The left shoulder is higher
- Head is in midline

3.3.2. Anthropometry measurement:

The examination was performed in the lower extremity

- Weight: 45 kg
- Height: 155 cm

Measurement of	**Right leg[cm]**	**Left leg[cm]**
Anatomical length	82	82
Functional length	80	80

Length of femur	41	41
Length of tibia-fibula	37	37
Length of foot	21	21

Table No 1- Anthropometric measurement of the lower extremity

Circumference of	**Right leg[cm]**	**Left leg[cm]**
Quadriceps	45	43
Vastus medialis	40	37
Knee	40	33
Calf	35	33
Ankle	22	22

Table No 2 - Circumferences measurements of the lower extremity

3.3.3. Gait examination:

*The examination was performed with crutches on the 2nd day after the surgery when the patient was able to walk with crutches after the instruction of her doctor.

- 20% loading on the operated leg and 80% on healthy
- The patient walking with good posture
- The patient was walking fluent with crutches
- No pain during the walking just some small spontaneous pain like a screw she said but on a special motions not always
- Short steps
- The patient did not feel any dizziness during walking
- Able to walk 3 point comfortable after my instructions

3.3.4. Palpation examination (muscle tone), by Lewit:

Muscle	**Right**	**Left**
Rectus femoris	hypertone	Eutone
Vastus medialis	hypertone	hypertone
Vastus lateralis	hypertone	Eutone
Vastus intermedius	Eutone	Eutone
Tensor fascia late	Eutone	Eutone
Adductors	hypertone	hypertone
Gastrocnemius	hypertone	hypertone
Soleus	Eutone	Eutone
Hamstrings	Eutone	Eutone
Biceps femoris	Eutone	Eutone

Table No 3 - Palpation examination of the muscles of lower extremity

3.3.5. Soft tissue examination, by Lewit:

*The examination performed the 2nd day because the patient was wearing the special bandage on her right leg on the first day

- Right fascia of the thigh: restricted to the rotational direction
- Left fascia of the thigh: not restricted
- Right fascia of the calf: restricted to the rotation direction
- Left fascia of the calf: not restricted

3.3.6. ROM examination, by Kendall:

HIP JOINT				
Plane	**Left**		**Right(operated)**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	10 -0- 75	15 -0- 80	10 -0- 60	15 -0- 70
S*	10 -0- 120	15 -0- 125	*	*
F	40 -0- 20	45 -0- 25	40 -0- 20	45-0-25
R_s	40 -0-25	45 -0- 30	**	**

Table No 4 - Range of motion examination of hip joint, by Kendall

[^{o}] = degrees

*: Hip flexion with flexed knee

** The examination can't performed because the patient can't flex her operated knee

KNEE JOINT				
Plane	**Left**		**Right(operated)**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	0 – 0 – 110	0 – 0 – 120	0 – 0 – 10	0 – 0 –20

Table No 5 - Range of motion examination of knee joint, by Kendall

[^{o}] = degrees

The examination of ROM of the knee provided the 2nd day because the 1st day the doctor said that the patient must not provide flexion of the knee.

ANKLE JOINT				
Plane	**Left**		**Right**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	40 -0- 25	45 -0- 25	40 -0- 10	40 -0- 15
R_S	20 -0- 30	25 -0- 35	20 -0- 30	25 -0- 35

Table No 6 - Range of motion examination of ankle joint, by Kendall

[^{o}] = degrees

The examination of the ankle provided in supine position on the bed.

3.3.7. Muscle strength test, by Kendall:

Tested muscle	**Right**	**Left**
Gluteus maximus	4-	5
Gluteus medius	4-	5
Gluteus minimus	4-	5
Lateral rotators of hip joint (Piriformis, quadratus femoris, obturator internus, obturator externus, gemell5s superior, gemellus inferior)	*: can't provide	5
Hip adductors (Pectineus, adductor magnus, gracilis, adductor brevis, adductor longus)	3+	5
Tensor fasciae latae	3+	5

Sartorius	*: can't provide	5
Iliopsoas (Psoas major, psoas minor, iliacus)	3+	5
Quadriceps femoris (Rectus femoris, vastus laterallis, v.intermedius, v.mediallis)	3+	5
Biceps femoris	*: can't provide	5
Semimembranosus	*: can't provide	5
Semitendinosus	*: can't provide	5
Popliteus	*: can't provide	5
Plantar flexors (Gastrocnemius, plantaris)	*: can't provide	5
Soleus	*: can't provide	5
Peroneus longus and brevis	4	5
Tibialis posterior	4	5
Tibialis anterior	4+	5
Gastrocnimeus	*: can't provide	5
Musculus plantaris	*: can't provide	5
Extensor digitorum longus and brevis	4	5
Flexor digitorum longus	4+	5
Flexor digitorum brevis	4+	5

Dorsal interossei	4+	5
Plantar interossei	4+	5
Extensor 47alluces brevis	4+	5
Extensor hallucis longus	4+	5
Flexor hallucis longus	4+	5
Flexor 47alluces brevis	4+	5
Abductor hallucis	4+	5
Lumbricalis	4+	5
Adductor hallusis	4+	5

Table No 7 - Muscle strength test, by Kendall

*: The patient was not able to provide the following muscle test because according to Kendall the position of the test is contra indication for the patient or the patients feels pain. The most of the positions that the patient can't provide is when the muscle test has flexion as a position of the operated knee joint.

3.3.8. Muscle length test, by Kendall:

Muscle	**Left**	**Right**
Gastrocnemius	0	0
Soleus	0	0
Trapezius	0	0
Levator scapulae	0	0

Table No 8 - Muscle Length test, by Kendall

0 = no shortness

3.3.9. Joint play examination, by Lewit:

Joint	**Right**	**Left**
Sacroiliac	no restriction	no restriction
Patella	can't provide	no restriction
Knee	can't provide	no restriction
Head of fibula	can't provide	restriction in ventrolateral direction
Ankle	no restriction	no restriction
Metatarsophalgeans	Restriction of the 1st toe in laterolateral direction	Restriction of the 4th and 5th toe in laterolateral direction

Table No 9 - Joint play examination, by Lewit

3.3.10. Movement pattern examination:

Movement:	**Right**	**Left**
Hip extension:	Glutei max and hamstrings activation is decreased because the patient feels pain.	Physiological
Hip abduction	Physiological with some pain	Physiological

Table No 10 – Movement pattern examination

3.3.11. Neurological examination:

Superficial sensation

- Dermatomes of Lumbar 1 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 2 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 3 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 4 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 5 segment in both extremities the patient felt the same/normal
- Dermatomes of Sacral 1 segment in both extremities the patient felt the same/normal
- Dermatomes of Sacral 2 segment in both extremities the patient felt the same/normal

Deep Tendon reflexes:

Type of reflex	Left	Right
Knee jerk reflex	2+	2+
Ankle reflex	2+	2+

Table No 11 – Deep tendon reflexes

2+ = Normal

3.3.12. Conclusion of examination:

The patient is one day after operation of Anterior Cruciate Ligament on the right knee. According the examination this operation does not affect only the right knee but also and other parts of the body that I will refer in the following points

- According the posture examination the most important sings are that the patient loading the operated 20% that's why she is standing on the lateral aspect of her foot. The calf and the thigh above the right leg is slight bigger, a sing that a swelling present around the operated knee. We can see also the different in the anthropometric measurements. There is also a scoliosis concave to the left side in lower thoracic and lumbar spine. The cervical area is flat. The position of the pelvis is slight tilted anteriorly.

- According the anthropometric measurements the circumference of the right quadriceps (15 cm above knee), vastus medialis (10 cm above knee), knee and the calf is bigger than the left side. With this we can say that the patient has swelling around the knee, above and under of the knee cause by the acute state from the operation.
- According the gait examination that provided on the 2nd day after the surgery because on the 1st day the patient advised from her doctor to stay on the bed for the whole day and do not stand. The 2nd day after the surgery the examination performed successful and the patient walk 3 point with her crutches after my instructions. I advise her to walk with loading 20% the operated and 80% the healthy leg. The patient feels slight pain and she was walking normally. For the 1st day of walk the distance was from one side of the room until the other side.
- According the palpation examination we can observe hypertone muscles on both sides of the leg especially on quadriceps and gastrocnemius and calf muscles.
- According the soft tissue examination there is a restriction of fascia of the thigh and calf on the right leg. Also it was slight painful during the examination.
- According to range of motion examination there is a restriction on the right side of leg in hip, (Flexion-Extension) knee (Flexion-Extension) and ankle (Dorsal flexion-Plantar flexion) joint. The patient feels pain due to the operation and she is not able to provide physiological ROM. The left side (healthy) is physiological.

- According the muscle strength test the healthy side of the patients is physiological and the patient was able to provide 5th grades in all muscle tests, we have to thinking that the patient was sports men and as we saw her muscle condition was very good. On the operated side the most muscles seems to be especially inactive and the patient was not able to provide maximum grades. Also in some muscle test on the operated side were unable to provide them due to the operation.
- According to muscle length test there is no shortness of her muscles.
- According the joint play examination there is no restriction of Sacroiliac joint and to the lower extremity but we can find restriction on the metatarsophalangeals joints in both sides of the feet.

- According to movement pattern examination there is decreased of activation of gluteus max and hamstrings due to the pain on the right side, so the patient does not provide physiological the hip extension of the right side.
- According the neurological examination dermatomes and reflexes are absolutely physiological in both sides.

3.4. Short – term and long- term physiotherapy plan:

3.4.1.Short-term:

- Decrease the pain as much as possible
- Increase the range of motion of the right knee joint in to flexion-extension individually as is possible from the patient pain
- Decrease swelling with soft ball techniques
- Soft tissue techniques for release of fascia of the thigh and the calf of the right leg
- Strengthening techniques (isometrics) and then active-passive movements) for the weak and inactive muscles on the lower extremity
- Mobilization of the peripheral joints on the lower extremity
- Support the patient's morality so we can work better as a team

3.4.2.Long –term:

- Maintain physiotherapy plan from the short-term
- Increase bigger ROM from short-term physiotherapy plan always individually
- More individual exercises for strengthening the weak and inactive muscles
- Maintain the mobilization of the peripheral joints
- PIR techniques for relaxation as is possible from the patients pain because of the uncomfortable positions
- Education of patient how to walk with crutches and normal and how to walk on the stairs up and down
- Improve posture during walking and educated her how have ergonomics posture in standing and sitting position

- Examination of the function of the trunk because the examination couldn't performed during the initial examination because the patient was one day after surgery

3.5. Day to Day therapy progress:

1st Day: 03/02/14 9:30 a.m.:

No movement of the right knee only for the first day.

Goals of today therapy:

- Reduce pain
- Reduce swelling
- Release the fascia of the right thigh and calf
- Increase Range of motion of the right hip and ankle joint. For today no any movement on the operated knee joint
- Mobilization of the restricted joints of the lower extremity
- Strengthening of weak and inactive muscles
- Deep vein thrombosis prevention

Therapy execution:

- Reduce pain:

Ice packs application for 7 minutes and if the patient feels any over cold of the right knee area, she must remove it immediately.

- Exercises to prevent Deep Vein Thrombosis:

Active plantar, dorsal flexion and circumduction movement of the ankle joint. The patient is in supine position on the bed. Ten repetitions, three sets each movement in both ankles. Active flexion and extension of the left knee joint. Ten repetitions, three sets.

Passive flexion of the right hip joint and active flexion of the left side. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. Active abduction and adduction of the hip joint. The patient is in supine position on the bed. Ten repetitions, three sets in both sides.

- Exercises for increase Range Of Motion:

For today because it is the first day the patient must not provide any movement in the right knee joint. The exercises for the increasing Range Of Motion of the hip joint provided combine with the exercises for Deep Vein Thrombosis prevention because is the same movements.

- Exercises for strengthening:

Isometric contraction of the quadriceps, gluteus, gastrocnemius on the both sides. The patient is supine on the bed. Ten repetitions, maximum contraction at the level of the pain. Elevation of pelvis with supporting hands on the bed. Ten repetitions, three sets.

- Mobilization of restricted joints:

The patient is supine on the bed and I apply joint play techniques by Lewit for mobilization of left head of fibula, and both sides' metatarsophalangeal joints of the feet.

- Facilitation with softball of the thigh and the calf of the right leg for reduce swelling (5 minutes).

- Soft tissue techniques by Lewit:

Lateral and medial waving techniques for release of fascia on the right thigh and calf.

Results:

Subjective:

- The patient feels very good after the therapy. She is still feels pain around the knee joint that's why our session was not so global of therapies. She is very happy at first with our session and we have a perfect communication as a patient and physiotherapist.

Objective:

- The range of motion of right knee join does not change because for the first day of the surgery there is no movement.
- Patient muscles are decreased in activation due to the pain and with the isometrics exercises a nice contraction is prevent.
- The fascia of the thigh still restricted but not as before the session. Now it is better and more released.
- The restricted joints now are moving with better mobility in all directions that were restricted.

2nd Day: 04/02/14 9:30 a.m.:

The patient today is able to start flex her knee as the level of her pain. She can also stand (20% operated and 80% healthy), walk on the corridor and on the stairs always with her crutches.

Goals of today therapy:

- Reduce pain
- Reduce swelling
- Release the fascia of the right thigh and calf
- Increase Range Of Motion of the right knee joint and hip joint
- Mobilization of the restricted joints of the lower extremity

- Strengthening of weak and inactive muscles
- Deep Vein Thrombosis prevention
- Verticalization of the patient from the bed. Education how to provide it correct with not any accident
- Education of patient how to walk with crutches 3-point and how to walk on stairs up and down

Therapy execution:

- Reduce pain:

Ice packs application for 7 minutes and if the patient feels any over cold of the right knee area, she must remove it immediately.

- Exercises to prevent Deep Vein Thrombosis:

Active plantar, dorsal flexion and circumduction movement of the ankle joint. The patient is in supine position on the bed. Ten repetitions, three sets each movement in both ankles. Active flexion and extension of the left knee joint. Ten repetitions, three sets.

Passive flexion of the right hip joint and active flexion of the left side. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. Active abduction and adduction of the hip joint. The patient is in supine position on the bed. Ten repetitions, three sets in both sides.

- Exercises for increase Range Of Motion:

Passive flexion and extension of the right operated knee joint until 20 degrees flexion and 0 degrees extension, that's the limit of this session. Ten repetitions and one set for today because the patient got tired and feel pain.

- Exercises for strengthening:

Isometric contraction of the quadriceps, gluteus, gastrocnemius on the both sides. The patient is supine on the bed. Ten repetitions, maximum contraction at the level of the pain. Elevation of pelvis with supporting hands on the bed. Ten repetitions, three sets.

- Mobilization of restricted joints:

The patient is supine on the bed and I apply joint play techniques by Lewit for mobilization of left head of fibula, and both sides' metatarsophalangeal joints of the feet.

- Facilitation with softball of the thigh and the calf of the right leg for reduce swelling (5 minutes).

- Soft tissue techniques by Lewit:

Lateral and medial waving for release of fascia on the right thigh and calf

Education how to walk 3-point with crutches and wearing an orthotic devise on the right leg. The patient walked around ten meters on the corridor with no so much pain but her walking seems to be antalgic, properly she afraid from her operation.

Walk on stairs in both directions and the patient wearing the orthotic devise on her right leg. The patient provides it one time up and down on the stairs with such pain.

- Increasing ROM of right knee joint:

Continues passive motion machine for this day 20 degrees flexion 0 degrees extension. Application for 30 minutes on the right knee joint.

Results:

Subjective:

- The patient is in better condition at the end of the 2nd therapy. She was able to follow my exercises and generally my instructions for all the session.

Objective:

- The Range Of Motion of right knee joint is increased in flexion until 20 degrees when the pain was present. For today it was only passively.
- The mobility of the fascia is better now in medio-lateral direction but still slight restricted.
- The patient stand for first time after the operation, loading 80% on healthy and 20% on the operated leg. She felt comfortable with not a big level pain. I also instruct her how to walk 3-pont 10 meters in the corridor. She also walked one time on stairs up and down with not any problem. She walked fluently.
- The restricted joints now are moving with better mobility in all directions that were restricted.

3rd Day: 05/02/14 9:30 a.m.:

The patient feels better today with nothing pain on the peripheral part of the body, only she feels pain on the area on the right knee joint but less level of pain
She is also able to do verticalization from the bed with not any problem

Goals of today therapy:

- Reduce pain as much possible
- Reduce swelling
- Release the fascia of the right thigh and calf

- Increase Range Of Motion of the right knee joint and expect over than 20 degrees passive flexion that yesterday's therapy. Also I expect that she will start to do it active flexion of the right knee joint
- Mobilization of the restricted joints of the lower extremity
- Strengthening of weak and inactive muscles
- Education of patient how to walk with crutches 3-point more distance than the previous therapy and how to walk on stairs up and down twice if it is possible from the patient
- Education of the patient how to turn in the bed from supine position to prone position and to initial position again

Therapy execution:

- Reduce pain:

Ice packs application for 7 minutes and if the patient feels any over cold of the right knee area, she must remove it immediately.

- Exercises for increase Range Of Motion:

Passive flexion and extension of the right operated knee joint until 35 degrees flexion and 0 degrees extension. Ten repetitions and two sets for today. During the therapy the patient was tolerating the pain. The patient provides also active flexion 20 degrees and extension 0 degrees of the right knee joint with not so much pain.
The patient provides also flexion and extension of the right knee in prone position on the bed with the same degrees and same times and repetitions.

- Exercises for strengthening:

Isometric contraction of the quadriceps, gluteus, gastrocnemius on the both sides. The patient is supine on the bed. Ten repetitions, maximum contraction at the level of the pain. Elevation of pelvis with supporting hands on the bed. Ten repetitions, three sets. Active plantar, dorsal flexion and circumduction movement of the ankle joint. The patient is in supine position on the bed. Ten repetitions, three sets each movement in both ankles. Active flexion and extension of the left knee joint. Ten repetitions, three sets. Passive

flexion of the right hip joint and active flexion of the left side. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. Active abduction and adduction of the hip joint. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. The patient provides also extension of the hip joint of both sides in prone position on the bed. Ten repetitions, three sets.

- Mobilization of restricted joints:

The patient is supine on the bed and I apply joint play techniques by Lewit for mobilization of left head of fibula, and both sides' metatarsophalangeal joints of the feet.

Facilitation with softball of the thigh and the calf of the right leg for reduce swelling (5 minutes).

- Soft tissue techniques by Lewit:

Lateral and medial waving for release of fascia on the right thigh and calf.

Walk 3-point with crutches and wearing an orthotic devise on the right leg. The patient walked around 20 meters on the corridor with no so much pain and with fluent walking

Walk on stairs in both directions and the patient wearing the orthotic devise on her right leg. The patient provides it two times in both directions on the stairs without pain

- Increasing Range Of Motion of right knee joint:

Continues passive motion machine for this day 35 degrees flexion 0 degrees extension. Application for 30 minutes on the right knee joint.

Results:

Subjective:

- The patient does not feel so much pain today and generally she feels very comfortable during the therapy.

Objective:

- The Range Of Motion of right knee joint is improve in flexion until 35 degrees passive. The patient provided also 20 degrees flexion of the right knee active. It was a very big success for her condition.
- The mobility of the fascia is better now in medio-lateral direction and it was not as restricted as the previous days.

- The patient stands, loading 80% on healthy and 20% on the operated leg. She felt comfortable with not so much level pain. She walked 3-point 30 meters in the corridor. She also walked two times on stairs up and down with not any problem. She walked fluently and correctly.
- The restricted joints now are moving with better mobility in all directions that were restricted.

4th Day: 06/02/14 9:30 a.m.:

The patient felt pain at 04:00 a.m. and she took painkillers. Now she is very good with the level of the pain is 2/10 *[scale from 1(minimum) to 10(maximum)]*.

Goals of today therapy:

- Reduce pain as much possible
- Reduce swelling

- Release the fascia of the right thigh and calf
- Increase Range Of Motion of the right knee joint and expect over than 35 degrees passive flexion from yesterday's therapy and also I expect that she will improve her flexion active more than 20 degrees.
- Mobilization of the restricted joints of the lower extremity
- Relaxation of hypertonic muscles with Post Isometric Relaxation by Lewit
- Strengthening of weak and inactive muscles
- Education of patient how to walk with crutches 3-point more distance from the previous therapy and how to walk on stairs up and down three times if it is possible from the patient

Therapy execution:

- Reduce pain:

  Ice packs application for 7 minutes and if the patient feels any over cold of the right knee area, she must remove it immediately.

- Exercises for increase Range Of Motion:

Passive flexion and extension of the right operated knee joint until 45 degrees flexion and 0 degrees extension.10 times, and three repetitions for today. During the therapy the patient was tolerating the pain. The patient provides also active flexion 30 degrees and extension 0 degrees of the right knee joint with not so much pain.

The patient provides also flexion and extension of the right knee in prone position on the bed with the same degrees and same repetitions and sets.

- Exercises for strengthening:

Isometric contraction of the quadriceps, gluteus, gastrocnemius on the both sides. The patient is supine on the bed. Ten repetitions, maximum contraction at the level of the pain. Elevation of pelvis with supporting hands on the bed. Ten repetitions, three sets. Active plantar, dorsal flexion and circumduction movement of the ankle joint. The patient

is in supine position on the bed. Ten repetitions, three sets each movement in both ankles. Active flexion and extension of the left knee joint.

Ten repetitions, three sets. Passive flexion of the right hip joint and active flexion of the left side. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. Active abduction and adduction of the hip joint. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. The patient provides also extension of the hip joint of both sides in prone position on the bed. Ten repetitions, three repetitions.

- Mobilization of restricted joints:

The patient is supine on the bed and I apply joint play techniques by Lewit for mobilization of left head of fibula, and both sides' metatarsophalangeal joints of the feet.

- Facilitation with softball of the thigh and the calf of the right leg for reduce swelling (5 minutes)

- Soft tissue techniques by Lewit:

Lateral and medial waving for release of fascia on the right thigh and calf.

- Post Isometric Relaxation techniques for relaxation by Lewit:

Application of Post Isometric Relaxation on gastrocnemius and adductors muscles of both sides for relaxation.

- Relaxation by massage:

The patient cannot provide relaxation techniques by Lewit to relax quadriceps muscle because the posture of the technique is totally uncomfortable for the patient, so I apply massage techniques for relaxation of her quadriceps muscles for 10 minutes.

Walk 3-point with crutches and wearing an orthotic devise on the right leg. The patient walked around 30 meters on the corridor with no so much pain and very good posture.

Walk on stairs in both directions and the patient wearing the orthotic devise on her right leg. The patient provides it three times in both directions on the stairs.

- Increasing Range Of Motion of right knee joint:

Continues passive motion machine for this day 45 degrees flexion 0 degrees extension. Application for 30 minutes on the right knee joint.

Results:

Subjective:

- The patient does not feel pain today, only 2 from 10 and generally she feels very comfortable during the therapy.

Objective:

- The Range Of Motion of right knee joint is improved in flexion until 45 degrees passive. The patient provided also 30 degrees flexion of the right knee active. It is a big success that day by day she is improving her Range Of Motion.
- The mobility of the fascia is better now in medio-lateral direction and it was not as restricted as the previous days.
- The patient stands, loading 80% on healthy and 20% on the operated leg. She felt comfortable with 2 from 10 level pain. She walked 3-point 40 meters in the corridor. She also walked three times on stairs up and down with not any problem. She walked fluently and correctly.
- The restricted joints now are moving with better mobility in all directions that were restricted.
- The hypertonic muscles relaxed as much possible

5th Day: 07/02/14 10:00 a.m.:

Today is the last day. The patient did not feel pain problems during the knight. Now she is very good with the level of the pain be 1/10 *[scale from 1(minimum) to 10(maximum)]*.

Goals of today therapy:

- Reduce pain as possible
- Reduce swelling
- Release the fascia of the right thigh and calf
- Increase Range Of Motion of the right knee joint and expect over than 45 degrees passive flexion from yesterday's therapy and also I expect that she will improve her flexion active more than 30 degrees.
- Mobilization of the restricted joints of the lower extremity
- Strengthening of weak and inactive muscles
- Relax hypertonic muscle with Post Isometric Relaxation techniques by Lewit.
- Education of patient how to walk with crutches 3-point more distance from the previous therapy and how to walk on stairs up and down three times if it is possible from the patient

Therapy execution:

- Reduce pain:

Ice packs application for 7 minutes and if the patient feels any over cold of the right knee area, she must remove it immediately.

- Exercises for increase Range Of Motion:

Passive flexion and extension of the right operated knee joint until 50 degrees flexion and 0 degrees extension.10 times, and three repetitions for today. During the therapy the patient was tolerating the pain. The patient provides also active flexion 45 degrees and extension 0 degrees of the right knee joint with not so much pain.

- Exercises for strengthening:

Isometric contraction of the quadriceps, gluteus, gastrocnemius on the both sides. The patient is supine on the bed. Ten repetitions, maximum contraction at the level of the pain. Elevation of pelvis with supporting hands on the bed. Ten repetitions, three sets. Active plantar, dorsal flexion and circumduction movement of the ankle joint.

The patient is in supine position on the bed. Ten repetitions, three sets each movement in both ankles. Active flexion and extension of the left knee joint. Ten repetitions, three sets. Passive flexion of the right hip joint and active flexion of the left side. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. Active abduction and adduction of the hip joint. The patient is in supine position on the bed. Ten repetitions, three sets in both sides. The patient provides also extension of the hip joint of both sides in prone position on the bed ten repetitions, three sets.

- Mobilization of restricted joints:

The patient is supine on the bed and I apply joint play techniques by Lewit for mobilization of left head of fibula, and both sides' metatarsophalangeal joints of the feet.

Facilitation with softball of the thigh and the calf of the right leg for reduce swelling (5 minutes).

- Soft tissue techniques by Lewit:

Lateral and medial waving for release of fascia on the right thigh and calf.

- Post Isometric Relaxation techniques for relaxation by Lewit:

Application of Post Isometric Relaxation on gastrocnemius and adductors muscles of both sides for relaxation.

- Relaxation by massage:

The patient cannot provide relaxation techniques by Lewit to relax quadriceps muscle because the posture of the technique is not totally uncomfortable for the patient, so I apply massage techniques for relaxation of her quadriceps muscles for 10 minutes.

Walk 3-point with crutches and wearing an orthotic devise on the right leg. The patient walked around 40 meters on the corridor with no so much pain and very good posture.

Walk on stairs in both directions and the patient wearing the orthotic devise on her right leg. The patient provides it three times up and down on the stairs.

- Increasing Range Of Motion of right knee joint:

Continues passive motion machine for this day 50 degrees flexion 0 degrees extension. Application for 30 minutes on the right knee joint.

Results:

Subjective:

- The patient does not feel pain today, only 1 from 10 and generally she feels very comfortable during the therapy. She achieve a very good Range Of Motion of the right knee joint 50 degrees flexion that's why the doctor suggested to her that tomorrow morning she will go home. She thanks me a lot for all session that we had together and also she is very satisfied for the help that I gave to her under my physiotherapy progress.

Objective:

- The Range Of Motion of right knee joint is improved in flexion until 50 degrees passive. The patient provided also 45 degrees flexion of the right knee active. It is absolutely in a perfect condition.
- The mobility of the fascia is better now in medio-lateral direction and it not restricted.
- The patient stands, loading 80% on healthy and 20% on the operated leg. She felt comfortable with 1 from 10 level of pain. She walked 3-point 40 meters in the corridor. She also walked three times on stairs in both directions with not any problem. She walked fluently and correctly.
- The restricted joints now are moving normally in all directions that were restricted.
- The hypertonic muscles relaxed as much as possible.

3.6. Final Kinesiological Examination

1. Postural examination

2. Anthropometry measurement

3. Gait examination

4. Palpation

5. Soft tissue examination

6. ROM examination

7. Muscle strength test

8. Muscle length test

9. Joint play examination

10. Movement pattern examination

11. Neurological examination

3.6.1.Postural examination (with crutches):

The patient was standing with crutches.

Posterior view:

- Short base of standing
- Standing normally on both feet
- The volume of calf is the same in both sides
- Slight valgosity of both knees
- The right popliteal line of the right knee is higher
- The volume of thigh is the same in both sides
- Scoliosis concave to the left side in lower thoracic and lumbar spine
- Flat cervical spine
- Left shoulder is slight higher
- Head is in the midline

Side view:

- Ankles are in correct alignment
- Knees are symmetrical
- Pelvis is in correct position
- Flat cervical spine
- Shoulders are protracted
- Head is forward and protracted

Anterior view:

- Short base of standing
- The circumference of both knees is the same
- The volume of thigh is the same in both sides
- Umbilicus is in midline
- Whole trunk is leans to the left
- Left shoulder is higher
- Head is in midline

3.6.2.Anthropometry measurement:

The examination was performed in the lower extremity

- Weight: 45 kg, Height: 155 cm

Measurement of	**Right leg[cm]**	**Left leg[cm]**
Anatomical length	82	82
Functional length	80	80
Length of femur	41	41
Length of tibia-fibula	37	37
Length of foot	21	21

Table No 12 – Anthropometric measurement of lower extremity

Circumference of	**Right leg[cm]**	**Left leg[cm]**
Quadriceps	43	43
Vastus medialis	37	37
Knee	35	33
Calf	33	33
Ankle	22	22

Table No 13 – Circumference measurement of lower extremity

3.6.3.Gait examination:

*The examination was performed with crutches. 3-point walking

- 20% loading on the operated leg and 80% on healthy
- The patient walking with very good posture
- The patient was walking with not any problem with crutches
- No pain during walking
- Normal steps during walking
- The patient did not feel any dizziness during walking
- Able to walk 3 point comfortable after my instructions

3.6.4.Palpation examination (muscle tone), by Lewit:

Muscle	**Right**	**Left**
Rectus femoris	Eutone	Eutone
Vastus medialis	Eutone	Eutone
Vastus lateralis	Eutone	Eutone
Vastus intermedious	Eutone	Eutone

Tensor fascia late	Eutone	Eutone
Adductors	Eutone	Eutone
Gastrocnemious	Eutone	Eutone
Soleous	Eutone	Eutone
Hamstrings	Eutone	Eutone
Biceps femoris	Eutone	Eutone

Table No 14 – Palpation examination (muscle tone), by Lewit

3.6.5.Soft tissue examination, by Lewit:

- Right fascia of the thigh: not restricted
- Left fascia of the thigh: not restricted
- Right fascia of the calf: not restricted
- Left fascia of the calf: not restricted

3.6.6.ROM examination, by Kendall:

HIP JOINT				
Plane	**Left**		**Right(operated)**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	10 -0- 80	15 -0- 90	10 -0- 80	15 -0- 90
S*	10 -0- 125	15 -0- 130	10-0-120	15-0-130
F	40 -0- 20	45 -0- 25	40 -0- 20	45-0-25
R_{s**}	40 -0-25	45 -0- 30	35-0-20	40-0-25

Table No 15 – Range of motion examination hip joint, by Kendall

[^{o}] = degrees

*: Hip flexion with flexed knee. On the right side the knee was 50 degrees flexion

** The examination performed with 50 degrees flexion of the right knee

KNEE JOINT				
Plane	**Left**		**Right(operated)**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	0 – 0 - 110	0 – 0 - 120	0 – 0 - 45	0 – 0 –50

Table No 16 – Range of motion of knee joint, by Kendall

[^{o}] = degrees

ANKLE JOINT				
Plane	**Left**		**Right**	
	Active Movement [^{o}]	**Passive Movement [^{o}]**	**Active Movement [^{o}]**	**Passive Movement [^{o}]**
S	40 -0- 30	45 -0- 25	40 -0- 25	45 -0- 30
R_s	20 -0- 30	25 -0- 35	20 -0- 30	25 -0- 35

Table No 17 – Range of motion of ankle joint, by Kendall

[^{o}] = degrees

The examination of the ankle provided in supine position on the bed the same as initial examination.

3.6.7.Muscle strength test, by Kendall:

Tested muscle	**Right**	**Left**
Gluteus maximus	5	5
Gluteus medius	5	5

Gluteus minimus	5	5
Lateral rotators of hip joint (Piriformis, quadratus femoris, obturator internus, obturator externus, gemell5s superior, gemellus inferior)	*: can't provide	5
Hip adductors (Pectineus, adductor magnus, gracilis, adductor brevis, adductor longus)	4+	5
Tensor fasciae latae	4+	5
Sartorius	*: can't provide	5
Iliopsoas (Psoas major, psoas minor, iliacus)	4+	5
Quadriceps femoris (Rectus femoris, vastus laterallis, v.intermedius, v.mediallis)	5	5
Biceps femoris	*: can't provide	5
Semimembranosus	*: can't provide	5
Semitendinosus	*: can't provide	5
Popliteus	*: can't provide	5
Plantar flexors (Gastrocnemius, plantaris)	*: can't provide	5
Soleus	*: can't provide	5

Peroneus longus and brevis	5	5
Tibialis posterior	5	5
Tibialis anterior	5	5
Gastrocnimeus	*: can't provide	5
Musculus plantaris	*: can't provide	5
Extensor digitorum longus and brevis	5	5
Flexor digitorum longus	5	5
Flexor digitorum brevis	5	5
Dorsal interossei	5	5
Plantar interossei	5	5
Extensor hallucis brevis	5	5
Extensor hallucis longus	5	5
Flexor hallucis longus	5	5
Flexor hallucis brevis	5	5
Abductor hallucis	5	5
Lumbricalis	5	5
Adductor hallusis	5	5

Table No 18- Muscle strength test, by Kendall

*: The patient was not able to provide the following muscle test because according to Kendall the position of the test is contra indication for the patient or the patients can't provide the required Range Of Motion . The most of the positions that the patient can't provide is when the muscle test has full flexion as a position of the operated knee joint.

3.6.8.Muscle length test, by Kendall:

Muscle	**Left**	**Right**
Gastrocnemius	0	0
Soleus	0	0
Trapezius	0	0
Levator Scapulae	0	0

Table No 19 – Muscle length test, by Kendall

0 = no shortness

3.6.9.Joint play examination, by Lewit:

Joint	**Right**	**Left**
Sacroiliac	no restriction	no restriction
Patella	can't provide	no restriction
Knee	can't provide	no restriction
Head of fibula	can't provide	no restriction
Ankle	no restriction	no restriction
Metatarsophalgeans	no restriction	no restriction

Table No 20 – Joint play examination, by Lewit

3.6.10. Movement pattern examination:

Movement:	**Right**	**Left**
Hip extension:	physiological	physiological
Hip abduction	physiological	physiological

Table No 21 – Movement pattern examination

3.6.11. Neurological examination:

Superficial sensation

- Dermatomes of Lumbar 1 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 2 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 3 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 4 segment in both extremities the patient felt the same/normal
- Dermatomes of Lumbar 5 segment in both extremities the patient felt the same/normal
- Dermatomes of Sacral 1 segment in both extremities the patient felt the same/normal
- Dermatomes of Sacral 2 segment in both extremities the patient felt the same/normal

Deep Tendon reflexes:

Type of reflex	**Left**	**Right**
Knee jerk reflex	2+	2+
Ankle reflex	2+	2+

Table No 22- Deep tendon reflexes

2+ = Normal

3.7. Evaluation of the effect of the therapy:

The effects of the therapy are successful and the patient's condition improved from the 1st day of our therapy until the last day. The patient and I achieve a very good cooperation and that was an important argument for our therapy's success. From the final examination the improvements are absolutely well done visible and that shows that we achieved that I task from the beginning of my therapy.

According the evaluation, the pain and the swelling starting to be decreased from the first days of therapy and that was a very positive point for me because we were able to continue our therapy more advance. The mobility of the fascia is not restricted anymore and the skin is not stiff so the patient provides the movements more comfortable. The first day of therapy the patient could not provide any movement of the right (operated) knee.

During our therapy, day by day the patient presents an improvement in flexion and extension of the right knee and every day we focusing to increase Range Of Motion as much possible. Also we increase the Range Of Motion of the hip and ankle joint in the operated side. The last day of the therapy (5th day) the patient had 50 degrees flexion of the right knee joint, something that satisfy her doctor, who let her go home the following day.

The group of muscles that were strengthened now are more activating and we can see an increasing on the muscle strength tests. An important role plays that now there is no pain that's why the patient can provide more strength during the tests.

According the palpation the group of muscles that tended to be with hypertonicity, after the post isometric relaxation and massage techniques that I provided to her now are more relaxed and there is less tension in a very high level from the first time of our sessions. Some peripheral joints that were restricted after joint play techniques by Lewit the mobility is now physiological.

After the daily walking on the corridor and on the stairs the patient is able to walk safe and know how use crutches physiological and away of any danger of falling and injury. She is walking very fluent and very comfortable.

It was an important task for me from the beginning to instruct her correct how to use crutches so after when she will go at her home to be able to do her activities of daily leaving as much ergonomics and safe.

3.8. Prognosis:

The patient is in a very good condition after our therapies. She is very young so if she follows the instruction of her doctor and continue the physiotherapy sessions, for sure she will improve her condition. She must be very careful when she is at home and generally she must care to be always safe and do not re-injured her right knee. Another important task is that she must be careful also during her training and instructed from some specialist how to avoid training errors and to not have any risk for another accident.

4. CONCLUSION:

As I am in the end of this Bachelor Thesis, I have to say that I am very satisfied with the results of my patient's case and also for my practice during these two weeks in Ústřední Vojenská Nemocnice.

After all the therapies, my patient is absolutely in a better condition after her surgery. We fulfilled all the goals that we put from the first time until the last day. The cooperation between me and her was perfect and we were always in a very good atmosphere. The patient was getting every day better and main goal to increase the ROM and remove the pain of the operated knee as much as possible was done in a very high level.

That's why the patient got the discharge note from her doctor in the fifth day after her surgery. Her doctor was also very satisfied with my therapies.

An important role for the success of my therapies is the help that I had from my supervisor and from all the staff of the department of orthopedics in Ústřední Vojenská Nemocnice.

Finally I want say that without the knowledge that I got from Department of Physiotherapy in Charles University in Prague, I couldn't be right practitioner and have the level of skills to work with my patient and also with the other patients with global types of problems.

5. BIBLIOGRAPHY:

5.1.Books:

1. Canale, T., & Beaty, J. (2012). *Cambell's Operative Orthopedic (12th ed.).* Philadelphia: Elsevier Inc

2. Clemente, D. (2006). *A Regional Atlas of the Human Body. (6th ed.).* Germany: Lippincott Williams & Wilkins

3. Drake, L., & Vogl, A. (2009). *Gray's Anatomy for Students. (2nd ed.).* United Kingdom: Churchill Livingstone Elsevier

4. Janda, V. (1983). *Muscle Function Testing (1st ed.).* United Kingdom: Butterworths Preparations

5. Kendal, F., Kendal, E., & et al. (2005). *Muscles Testing and Function with Posture and Pain. (5th ed.).* Baltimore: Lippincott Williamns & Wilkins

6. Kweon, C., & Lederman, E., et al. (2013). *The Multiple Ligament Injured Knee: A Practical Guide to Management (1st ed.).* New York: Springer Science and Business Media

7. Lewit, K., & Richard, M. (2009). *Manipulative Therapy: Musculoskeletal Medicine (1st ed.).* Baltimore: Elsevier Limited

8. Moore, L., & Dalley, A. (2010). *Clinically Oriented Anatomy. (6th ed.).* United States of America: Lippincott Williams & Wilkins

9. Murray, M., & Vavken, P., et al. (2013). *The ACL handbook. Knee Biology, Mechanics and Treatment (1st ed.).* United States of America: Springer Science and Business Media

10. Paulsen, F., & Waschkc, J. (2010). *Sobbota Atlas of Human Anatomy. (15th ed.).* Munchen: Elsevier Urban & Fischer

11. Rohkam, R. (2004). *Color Atlas of Neurology (2nd ed.).*Germany: Grammlich, Pliezhausen

12. Tortora, J., & Derrickson, B. (2009). *Principles of Anatomy and Physiology. (20th ed.).* United States of America: John Wiley & Sons, Inc

5.2.Electronic Journal Articles:

13. Childs, S. (2002). *Pathogenesis of Anterior Cruciate Ligament Injury*, 21, 35-40. Retrieved March 15, 2014 from ProQuest Education Journal Data Base

14. Isberg, J. (2008). *Kinematics and laxity in the knee, before and after Anterior Cruciate Ligament reconstruction,* 10, 4-78. Retrieved March 15, 2014 from ProQuest Education Journal Data Base

15. Klass, D., Toms, A., et al. (2007). *MR Imaging of Acute Anterior Cruciate Ligament injury,* 10 340-346. Retrieved March 17, 2014 from Elsevier Journal Data Base

16. Malanga, G., Andrus, S., et al. (2003). *Physical Examination of the Knee: A Review of the Original Test Description and Scientific Validity of Common Orthopaedics Tests,* 84, 592-603. Retrieved March 16, 2014 from American Journal Association Data Base

17. Melnyk, M., Faist, M., et al. (2007). *Changes in Stretch Reflex Excitability Are Related to "Giving Way" Symptoms in Patients With Anterior Cruciate Ligament Rupture,* 97, 474-480. Retrieved March 16, 2014 from American Physiological Society Data Base

18. Muhle, C., Joong, A., et al. (2013). *Diagnosis of ACL and Meniscal Injuries: MR Imaging of knee flexion versus extension compared to arthroscopy,* 2, 1-10. Retrieved March 17, 2014 from Springer Open Journal Data Base

19. Reed, M. (2013). *Anterior Cruciate Ligament Reconstruction with Patellar or Hamstring Tendon Graft: A review of the Evidence,* 1, 1-15. Retrieved March 16, 2014 from The West London Medical Journal Data Base

20. Scholten, R., Opstelten, W., et al (2003). *Accuracy of Physical Diagnostic Tests for Assessing Ruptures of the Anterior Cruciate Ligament: A Meta-Analysis,* 52, 689-694. Retrieved March 16, 2014 from The Journal Family Practice Data Base

21. Siegel, L., Vandenakker, C., et al. (2012). *Anterior Cruciate Ligament Injuries: Anatomy, Physiology, Biomechanics, and Management*, 22, 249-355. Retrieved March 15, 2014 from Lippincott Williams & Wilkins Data Base

5.3.Lectures:

22. Čemusová, J. (2011). *Introduction to rehabilitation: Physiotherapist and patient`s past history.* Lecture`s notes. Charles University in Prague

23. Jalovcová, M. (2011). *Examination and basic therapeutic methods I: Anthropometric measurements.* Lecture`s notes. Charles University in Prague

24. Jelínková, I. (2012). *Examination and basic therapeutic methods II: Goniometry. Lecture`s notes.* Charles University in Prague

25. Jelínková, I. (2012). *Examination and basic therapeutic methods II: Muscle strength testing.* Lecture`s notes. Charles University in Prague

26. Jelínková, I. (2012). *Examination and basic therapeutic methods II: Walking examination.* Lecture`s notes. Charles University in Prague

27. Satrapová, L. (2013). Physiotherapeutic methods: ACL Reconstruction. Lecture`s notes. Charles University in Prague

6. SUPPLEMENTS:

6.1. List of Tables:

6.2. List of Pictures:

6.3. Abbreviations:

- UVN: Ústřední Vojenská Nemocnice
- ACL: Anterior Cruciate Ligament
- ROM: Range Of Motion
- PIR: Post Isometric Relaxation
- CPM: Continues Passive Motion Machine
- F: Flexion
- E: Extension
- R: Rotation
- DF: Dorsal Flexion

- PL: Plantar Flexion
- MRI: Magnetic Resonance Imaging
- CI: Contra Indication
- I: Indication
- SI: Sacroiliac
- DVT: Deep Vein Thrombosis

6.4. Photo documentation:

The patient did not allow me to take photos of her. The only photo that she was acceptable to take is her knee exactly after the surgery.

Date: 03/02/14:

6.5.APPLICATION FOR ETHICS BOARD REVIEW

CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
José Martího 31, 162 52 Praha 6-Veleslavín
tel. +420 2 2017 1111
http://www.ftvs.cuni.cz/

Application for Ethics Board Review

of the undergraduate research, involving human subjects

Project title: Case study of a patient with the diagnosis of one day after ACL surgery
Nature of the research project: Bachelor thesis
* Please delete as appropriate.

Author (chief investigator): Pavlos Chartosias
Co-investigators:
Supervisor (in case of student research): Mgr. Jelinkova Ivana

Research project description also involves the case study of the patient who had an operation of ACL surgery. My practice was performed at Ústřední Vojenská Nemocnice.
Guaranteed safety to be judged by experts: no invasive methods were used
Ethical aspects of the research: personal data obtained during the case study will not be published.
Informed consent (attached)

Date: 10.02.14 Author's signature:

Faculty of Physical Education and Sport, Charles University in Prague
ETHICS BOARD REVIEW

Ethics Board members: Doc. MUDr. Staša Bartůňková, CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.
Approval number: 104/2014
Date: 3.3.2014

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and **found no contradictions with valid principles**, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

Official school stamp

UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6
1

Signature, REB Chairman

INFORMOVANÝ SOUHLAS

V souladu se Zákonem o péči o zdraví lidu (§ 23 odst. 2 zákona č.20/1966 Sb.) a Úmluvou o lidských právech a biomedicíně č. 96/2001, Vás žádám o souhlas k vyšetření a následné terapii. Dále Vás žádám o souhlas k nahlížení do Vaší dokumentace osobou získávající způsobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uveřejněním výsledků terapie v rámci bakalářské práce na FTVS UK. Osobní data v této studii nebudou uvedena. Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl. Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií. Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:……

Osoba, která provedla poučení:……

Podpis osoby, která provedla poučení:……

Vlastnoruční podpis pacienta /tky:…….